SCIENTIFIC AMERICAN

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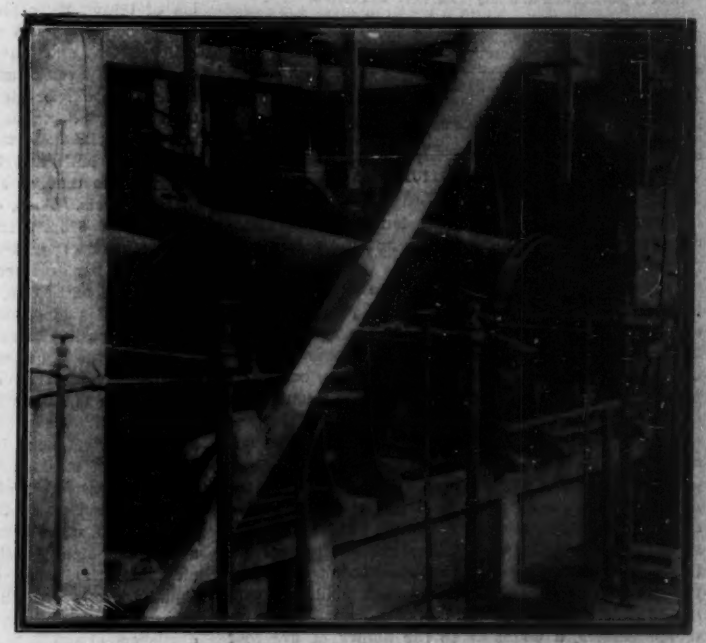
Roughening Burr Stones.



Heating the Grain in Rotary Heaters.

The Roller Mills Making "Patent" Flour.

HOW BREADSTUFFS ARE MADE IN QUANTITY.

FLOUR MILLING AS CONDUCTED IN THE LARGEST MILLS IN THE WORLD. CAPACITY, 30,000 BARRELS A DAY.—[See page 176.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, FEBRUARY 27, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SALT WATER FIRE PROTECTION FOR NEW YORK CITY.

Irreparable as is the loss occasioned by such disasters as the theatre fire at Chicago, and the recent conflagration at Baltimore, it is probable that the ultimate benefit to the general public far exceeds the local blotting out of life and destruction of property, great as it may be—and to this extent, if the sufferers can be so philosophical as to see it that way, they are paying the price for an enormous, never-ending benefit to humanity at large. The great theatre fire resulted in an immediate and sweeping investigation of theatre conditions, not merely throughout the United States, but, as we now learn, in every country in which adequate protection had not already been made against theatre fires. And now the aftermath of the Baltimore fire is seen in the widespread investigation which is being made to ascertain how far other great cities are exposed to the danger of a similar sweeping conflagration, should a fire once get a thorough hold in a congested district. Already there is, even among conservative engineers, a doubt as to the ability of fireproof buildings to act as fire screens, and protect the buildings that are to leeward of them from the onrush of a big city fire, driven by a gale of wind. It is also generally accepted that in the present state of our fire-fighting apparatus, the security of New York depends entirely upon the ability of our very efficient fire department to smother a fire before it becomes a conflagration; and the conviction is growing that, should a conjunction of unfavorable circumstances, such as a heavy fall of snow, a fire in a congested district of old buildings, and a sweeping gale occur, rendering it impossible for our fire department to smother a fire at the outset, it might easily grow to an extent which would render even our admirable New York city force helpless to stop it. Hence the need for some auxiliary system of fire protection, by which it would be possible to flood a threatened district with an immense volume of water.

The system that is finding the most favor is one that has been frequently proposed in past years for installation in New York city. But in this, as in many other advanced municipal improvements, while New York has been talking, the provincial cities have been acting, and Philadelphia is to-day equipped with a system of salt-water mains and powerful pumping plants, by which water may be drawn from the Delaware and delivered in great volume and under high pressure at a fire in any part of the principal business sections of the city. Cleveland also has a similar installation. Here in New York, the configuration of Manhattan Island is extremely favorable to the installation of such a system, and we are much pleased to see that our very wide-awake and capable Mayor has added to the many excellent suggestions that he has made in the few weeks of his term of office, by writing a strong letter to the Fire and Water Commissioners and the Board of Fire Underwriters, recommending that a system of mains be laid through the streets of the downtown portion of the city, and that separate pumping stations be established, thereby giving the city an entirely new and powerful supply of fire-fighting apparatus independent of the present city water supply. There is much to be said in favor of the plan, although the average citizen may well gasp at the contemplation of the widespread tearing up of the streets which will be involved in carrying out such a scheme. If Mayor McClellan's suggestion be acted upon, the work should not be started until the plans are thoroughly matured, and it should then be rushed through with all the expedition that unlimited capital and men can secure.

THE PROPOSED NAVAL APPROPRIATION.

To everyone who is at all familiar with the present trend of events in the design of ships of war, the character of the additions to our navy which are proposed by the Naval Affairs Committee will be in every way satisfactory. There was a division of opinion in the committee as to whether the proposed increase should include a considerable tonnage of fast unprotected cruisers, or less of these and more vessels of the battleship and armored cruiser class. We are gratified to see that the advocates of armored ships prevailed, and that it is proposed to increase our navy by one first-class battleship of 16,000 tons, to cost $7,775,000; two first-class armored cruisers of 14,500 tons, each to cost $6,505,000; and three scout cruisers of not over 3,750 tons displacement, each to cost $2,200,000, and two colliers to cost each $1,250,000. Of the total tonnage of warships thus proposed of 56,000 tons, four-fifths will be heavily armed and armored vessels capable of taking their place in the front line of a fleet engagement. This is as it should be. We have long believed that one ton of displacement in a battleship or heavily armed and armored cruiser is worth more as a determining factor in the issues of war than many tons in unprotected vessels of the cruiser and scout class. It takes but a glance at the list of ships now built and building for the United States navy, to see that we are relatively very strong in armored vessels. Thus, out of a total tonnage built and building of 616,275 tons, 496,000 tons, or over two-thirds, consists of armored vessels, of which more than sixty per cent are first-class battleships.

The new battleship, which will be a sister to the "Louisiana" and "Connecticut," will be one of the largest ships in the world, displacing 16,000 tons. She will have the American characteristic of carrying a heavier battery than any vessel afloat, not even excluding the 16,350-ton British battleships of the "King Edward VII." class. For defense she will rely upon an 11-inch waterline belt, a 4½-inch protective deck, 10 inches of steel on the heavy gun positions, and a broadside protection of 7 inches of steel carried from the main belt up to the main deck. She will mount four 12-inch, eight 8-inch, twelve 7-inch, twenty 3-inch, and twenty-eight smaller guns. This ship will be considerably the most powerful fighting unit afloat. Equally effective in the armored cruiser class will be two new vessels of the "Tennessee" type, of 14,500 tons displacement and 22 knots speed, with a 6-inch waterline belt, and 9-inch and 5-inch protection for the gun positions, carrying four 10-inch, sixteen 6-inch, twenty-two 3-inch, and twenty-four smaller guns. If the 5 inches of side and battery armor had only been 6 or 7 inches in thickness, these ships with their four 10-inch guns in the main battery, would be as much entitled to rank as battleships as do the three vessels of the "Pobieda" class in the Russian navy.

The cruiser scouts will probably be of the new class of boats which was introduced by the "Novik" of the Russian navy, a 3,000-ton scout of 26 knots speed, carrying half a dozen 4.7-inch guns. The "Novik" has been termed the destroyer of destroyers, in recognition of her supposed ability to run down and sink torpedo-boat destroyers. She showed up rather ingloriously at her first opportunity, which occurred recently at Port Arthur, for she was among the vessels disabled in that engagement. The two colliers which it is proposed to build are a type of vessel that is recognized as absolutely essential to the proper mobility of a modern fleet. They are really floating coaling stations, and we look to see a great development of this type in the future.

ELECTRICITY IN MINES.

The departmental committee appointed by the British government to investigate into the subject of the utilization of electricity in mines for the purpose of promoting precautionary and safety regulations concerning the same has issued its report. In this, the committee realize the extent to which electricity will be used in mining, and they favor the alternating current as being the best adapted to the work. They point out the greater safety attending the use of electricity if properly controlled. Concerning the potential of the current employed, they suggest 650 volts as the maximum at the face, but higher voltage in other parts of the mine. The necessity of a first-class installation is emphasized, and they state that electrical power must always be regarded as a powerful danger, and the current switched off and all subterranean machinery instantly stopped upon the slightest detection of gas, to prevent the possibility of explosions, accidents, and so forth, by short circuits, etc.

The general principles governing installations of electricity in mines which the committee suggest are as follows: (1) That explosives should always be treated as a source of potential danger. (2) That explosives and all apparatus connected with their use should be of thoroughly good character, and that all of bad quality should be immediately discarded. (3) That the handling of explosives should be limited to competent persons. (4) That in the case of danger from the presence of gas, precautions should be taken to insure thorough ventilation in order to remove the source of danger, and that no shot should be fired until all gas has been removed. Though we do not wish to imply that the risks attendant on the use of electricity where an installation is properly put in in the first place, and maintained in good order, are comparable to those which are and must be attendant on the use of explosives, at the same time we cannot shut our eyes to the fact that if an installation is not of thoroughly good quality and also maintained in a state of efficiency, it must add one more to the several dangers which it is the lot of the miner to face in his daily occupation. To follow out the above analogy, we think the general principles which should govern the employment of electricity in mines are as follows: (1) The electric plant should always be treated as a source of potential danger. (2) The plant in the first instance should be of thoroughly good quality, and so designed as to insure immunity from danger of shock or fire, and periodical tests should be made to see that this state of efficiency is being maintained. (3) All electrical apparatus should be under charge of competent persons. (4) All electrical apparatus which may be used when there is a possibility of danger arising from the presence of gas should be so inclosed as to prevent such gas being fired by sparking of the apparatus.

With regard to cables, there are special rules for guarding against the introduction of water within the insulating material in damp places; also for the substantial fixing of cables in shafts and for special protection where the cables in underground roads cannot be fixed at least a foot beyond the reach of any tub or tram. Cables, when suspended, are to be so fixed that in the event of a fall they will break away without damaging themselves, and trailing cables for portable machines are to be heavily insulated and armored. A coal-cutting motor is not to be kept continuously at work beyond a maximum time, to be fixed in writing by the superintendent. Current supplied for use on trolley wires with an uninsulated return is to be generated separately and not taken from lines used for any other purpose. Provision is made for the guarding of arc lamps against the possibility of ignited carbon falling. Arc lamps are not to be used when there is dangerous coal-dust. Vacuum lamps alone may be used, inclosed in gas-tight fittings. There is also provision for the supply of safety lamps in case of failure of the light. One section deals with shot-firing. The cable is in no case to be less than 25 yards long and the handle or plug of the firing apparatus is to be detached when not in use. Lighting and power cables are not to be used for firing shots except with the provision of special locked boxes for the firing plug or button.

EMISSION OF N-RAYS BY THE HUMAN BODY, ESPECIALLY THE MUSCLES AND NERVES.

M. Charpentier's discovery that the nerve centers and muscles of the human body give off a special kind of radiation has already been discussed in last week's issue. A few additional details have been sent to us by our Paris correspondent, which go to supplement what has thus far been published. Whatever may be the ultimate bearing of the discovery, the facts alone are of value, and further progress in investigating these phenomena will be watched with interest. The experimenter presents an account of his first work at a recent meeting of the Academie des Sciences.

While repeating in his laboratory some of M. Blondlot's experiments on the production and effects of the N-rays, M. Charpentier had occasion to observe a series of new phenomena which seemed to have considerable importance from a physiological standpoint. One of the most convenient methods of observing the N-rays is to receive them in the dark upon a phosphorescent substance of small luminosity, and the rays show themselves by increasing the light given off by the body. Fluorescent substances answer very well for the test screens, and one of the best methods is to use a platino-cyanide of barium screen whose luminous intensity is regulated by a radium salt covered with black paper and placed at a variable distance. The rays from the radium thus excite the screen and make it more or less brilliant. Such a screen then serves to reveal the presence of the N-rays by increasing in brightness when the latter are allowed to fall upon it.

The phosphorescent or fluorescent screen is found to increase in brightness when it is brought near the human body. The effect is strongest in the neighborhood of the muscles and nerves. Contracting the muscle heightens the effect. In the case of nerves or nerve centers, the phenomenon is shown more clearly as the degree of working of the nerve or center increases. In this way the presence of a surface nerve can be recognized and the path of the nerve can even be followed by exploring it with the test body. These effects are not only observed on contact with the skin, but can be perceived at a distance. The action takes place through substances which are transparent for the N-rays (aluminium, paper, or glass), and it is stopped by screens which are opaque for the rays, such

as lead or wet paper. The effect is not due to an increase of temperature in the neighborhood of the skin, as it keeps up when several sheets of aluminium or paper are interposed (separated by layers of air), and thus screen off the heat.

The rays given off by the body are reflected and refracted like the N-rays, and M. Charpentier was able to produce foci, which were indicated by the maximum brightness, by means of glass lenses. The index of refraction of the rays seems to be near that of the N-rays.

It may be thought that the body only receives and stores up the rays during the day, like the bodies which M. Blondlot exposed to the sun. But after remaining for nine hours in complete darkness, the phenomena showed themselves as usual.

The remarkable fact seems to be demonstrated that the human body gives off the N-rays. It is the tissues of the organism whose activity is the strongest which emit the rays in the greatest degree. These phenomena seem to be of capital importance in studying nervous action especially, as the nerves or brain are now found to exert an action on the exterior which remained unknown up to the present.

One striking experiment as to the effect of the muscles is that the area of the heart can be defined by exploring the region with a small test-screen. As this organ is in great muscular activity, its effect is considerable. When the small luminous screen is moved about the surface of the body in the region of the heart, the outline of this organ and its surface are manifested by the variations in brightness. Similar experiments are now being carried on with the brain and the rest of the nervous system, and the results are awaited with interest.

FLEETS IN THE FAR EAST—AN ENGLISH REVIEW OF THE POSITION OF RUSSIA AND JAPAN.

BY ARCHIBALD S. HURD, OF LONDON, ENGLAND.

It has not yet been realized seemingly by the world that Russia in the immediate future is determined to be essentially an Asiatic rather than a European power and that Port Arthur and Dalny will be her front doors and not, as was at one time supposed, her back doors. She is turning her face toward the sun, which has been denied to her hitherto in Europe, and her energies will be directed increasingly to the exploitation of the slice of China which she has secured and which it may be accepted as certain that, unless it be wrested from her by Japan, she will give up under no threats by whomsoever made. Plans which have been unfolding for several years past and have swallowed up several hundred millions sterling depend upon the ability of the Muscovite power to retain her nominal hold on Manchuria until the moment comes when she feels strong enough to throw off all reserve and, on one pretext or another, to annex this territory, one of the richest sections of China, wherein lies buried mineral wealth of untold value, with a population of about nine millions near at hand for its recovery.

In reviewing the naval situation it is not without interest to glance back over the course of events in the Far East—surely a unique record. In 1894, when Japan had defeated China, Russia, with the support of Germany and France, intervened and refused to permit Japan to hold Port Arthur, which she had captured from the Chinese after a long and most costly campaign. It was claimed that the integrity of China must be preserved in the interest of the peace of the world. Great Britain, though she did not throw in her lot with the other three powers, found their policy in agreement with that upon which she had insisted, and America stood aloof on similar grounds. Desiring the maintenance of China as an independent power, neither nation could with grace assist Japan to rob it of one of its best *points d'appui*, even by conquest. Not very many years had passed when the world was astonished to learn that two of the protectors of China had obtained "leases" of Chinese territory. Germany, in November, 1897, seized Kiau-Chau, and Russia obtained Port Arthur in the following January, and these examples were imitated by France and Great Britain. This was followed by the announcement that the Tzar had devoted £9,000,000 sterling from the War Chest to the carrying out of a great shipbuilding programme. It was subsequently ascertained that this sum was in addition to the ordinary navy votes, which had been rising for several years. The world heard next that Russia had obtained important concessions in Manchuria and that she planned to bring her trans-Siberian railway down to Port Arthur. In 1900 China proved a useful instrument toward the furtherance of Russian policy. The "Boxer" troubles gave the Russians the opportunity of pouring troops into Manchuria, nominally to guard the railway, then fast creeping down to the long-desired warm water. These troops have not been withdrawn and their number has been increased month by month. Since she first obtained her hold on China, "Russia," in the words of Dr. Morrison, of the Times, "has transformed Manchuria from a Chinese province to a virtually Russian possession."

Diplomacy has been supported at every step by naval power, often more imposing in array than dangerous in warfare. Since 1895 practically every battleship as it has been completed for sea has been commissioned, not for service in the Baltic, but for the Far East. With amazing rapidity Russia, which hitherto has had one fleet in the Baltic, frozen up for six months of the year, another in the Black Sea, nominally at least immured by the provisions of the Treaty of Paris, and a small force in the land-locked Caspian Sea, has created yet another squadron, more powerful than either of the others, and at Vladivostok and Port Arthur naval bases have been equipped, with a large dock at each place, and building facilities for torpedo craft at the latter. Meantime the great shipyards of Russia and of France, Germany, and the United States have been busy building for Russia additional men-of-war of the most powerful types.

A point which is often overlooked is that the development of Russian plans has been so hurried that the work has not yet been rendered sufficiently strong to bear the strain of a contest. In the Russian fleets in the Black Sea and the Far East are embodied pushful diplomacy—diplomacy with a mailed fist; but they are distinct and entirely separate, with over 12,000 miles of sea intervening. The ships which are built in the Black Sea remain in the Black Sea. Ships pass from Europe to the Far East, it is true, but they can travel from the Baltic to the Pacific only with the aid of coal obtained at British coaling stations. At Port Said or Suez, at Aden and at Singapore, Great Britain holds the lines of communication between these two fighting forces of Russia; and France, her ally, can render no assistance after the eastward-bound ships leave the Mediterranean. For the transport of stores and ammunition, Russia has the trans-Siberian railway. Is it realized by those who make much of this wonderful engineering achievement that the distance from Russia's arsenals at Moscow and St. Petersburg to Port Arthur is twice as great as from New York to Liverpool, or again more than twice as great as from Montreal to Vancouver by the Canadian Pacific Railway? Moreover, the trans-Siberian railway has been hastily and not too well laid. Consequently, under the most favorable circumstances stores sent from St. Petersburg or Moscow to Port Arthur take three weeks to reach their destination if sent by the best passenger train shown in the latest time table issued by the Russian government. This line would have to serve, after the commencement of war, for the transport of all stores for the army and navy, and those who are familiar with the difficulties attending the working of a long length of single rail in time of war will appreciate its value under such circumstances. Another point to be borne in mind is that its course through China must be heavily guarded by troops and that thousands of the Chinese would risk a good deal, if Russia were on the defensive, to cripple this line of communication by destroying a portion of the permanent way or blowing up one of the numerous bridges.

When it is said, therefore, that Russia's position as a naval power is unique, it will be admitted that her difficulties are of no ordinary character. Up to the present war she has triumphed. Every step in her programme of empire building in the Far East has been carefully planned years ahead, every preparation made, and only when she has assured herself that everything is in readiness has she, as opportunity has offered, taken the world into her confidence and stood firm by her intentions.

Since she obtained the "lease" of Port Arthur, Russia has made wonderful progress; but the scheme is not complete, and herein lies the explanation of her evasive diplomacy when she has been approached by one or other of the powers seeking assurances that she will withdraw her troops from Manchuria. It is now common knowledge that while these undertakings have been freely given, ships and men have been quietly massed in Far Eastern waters, stores have been accumulated, and every preparation made to hold what she has obtained.

Russia has already unostentatiously assured her military position by drafting something over 100,000 troops into Manchuria, but she clearly realizes that her future in the Far East depends less upon her soldiers than upon her ships and sailors. In the latter respect she is not yet ready. It was reported repeatedly in cablegrams, mostly coming through Shanghai, that Russia had "ninety warships" massed at or near Port Arthur. Though Russia has made the most of resources, this is a gross exaggeration. She has accumulated a large number of non-fighting ships in the Far East because she realizes that the Asiatic judges the menace of naval power less by guns and armor than by the number of funnels and the general impression conveyed by an array of ships of all types. Wise in her knowledge of the eastern mind, Russia has borrowed merchant ships and acquired many of the volunteer fleet to swell the fleet in Far Eastern waters, and she has succeeded not only in impressing the Asiatic, but, what she can hardly have hoped for, the European as well. What, then, is the strength of the naval forces of Russia in Chinese waters available for action? Below is a list of all the ships which Russia and Japan have ready.

RUSSIA.	JAPAN.
Battleships (8).	*Battleships* (6).
"Peresviet,"	"Fuji,"
"Poltova,"*	"Yishima,"
"Petropavlosk,"	"Asahi,"
"Pobieda,"	"Hatsuse,"
"Retvisan,"*	"Shikishima,"
"Sebastopol,"	"Mikasa."
"Osliabia,"	
"Czarevitch."*	
Cruisers (18).	*Cruisers* (24).
"Rossia,"†	"Asama,"†
"Rurik,"†	"Tokiwa,"†
"Gromoboi,"†	"Azuma,"†
"Bayan,"†	"Kasagi,"†
"Dmitri Donskoi,"†	"Chitose,"
"Aurora,"	"Kasagi,"
"Boyarin,"*	"Takasagi,"
"Pallada,"*	"Yoshino,"
"Askold,"*	"Akashi,"
"Bogatyr,"	"Yakumo,"†
"Novik,"*	"Idsumo,"†
"Razboynik,"	"Iwate,"†
"Djigit,"	"Niasin,"†
"Zabiyaka,"	"Yayeyama,"
"Diana,"*	"Chiyoda,"
"Variag,"*	"Hashidate,"
"Korietz,"*	"Itsukushima,"
"Yenisei."*	"Matsushima,"
	"Suma,"
	"Akitsushima,"
	"Isuma,"
	"Naniwa,"
	"Takachiho,"
	"Sai-yen."
Torpedo Craft.	*Torpedo Craft.*
2 gunboats.	4 gunboats.
19 destroyers.	20 destroyers.
12 torpedo boats.	38 torpedo boats of the first class.
Russia has in addition a number of transports, gun vessels and non-fighting ships.	39 torpedo boats of the second and third classes.
	Japan possesses many other non-fighting ships.

(To be continued.)

SCIENCE NOTES.

The English Board of Agriculture and Fisheries recently completed an interesting research concerning the swimming powers of fish. On May 8 last year, a number of marked fishes were liberated in the North Sea. On January 28 last a steam trawler landed a plaice, which according to the mark upon it was one of the liberated fishes. It had traveled 136 miles from where it was released to the place where it was caught.

It is said that the Navy Department will establish a branch naval observatory in Samoa, and that $8,000 has been allotted for this purpose. The justification for such an institution is that it will afford astronomical observation in a field almost undeveloped, such as discovering a list of 500 of the 1,597 stars adopted for publication in the Nautical Almanac of the United States, Great Britain, France and Germany at a conference of the directors in 1896, for the accurate determination of time for the use of navigators in that far distant section of the national domain, and for the determination of the magnetic elements, knowledge of which is so important to navigation.

The late Dr. John Hall Gladstone, before his death, carried out an investigation of fluorescent and phosphorescent diamonds. Chaumet, Dr. Gladstone pointed out in two brief papers read before the British Association, had recently announced that violet light renders diamonds, especially the more valuable stones, phosphorescent; a yellow stone which would not fluoresce, turned brown after an exposure of a few minutes, but was restored to its color and brilliancy in 24 hours. This phenomenon was described by Dr. Gladstone at the Aberdeen meeting of 1859; three stones of a ring which he then exhibited were somewhat fluorescent in daylight and phosphoresced in the dark; exposure to violet and ultra-violet rays produced the strongest phosphorescence. As not one of a collection of other valuable diamonds showed any phosphorescence, Dr. Gladstone was inclined to attribute the peculiarity to some unknown impurity not usually found in stones of the first water. The ring mentioned was exhibited again a few years ago by Prof. Silvanus Thompson at the Royal Institution; it lost its phosphorescent power completely afterward, and regained part of it after having been kept in the dark for a year. An accidental fire has finally put an end to this investigation.

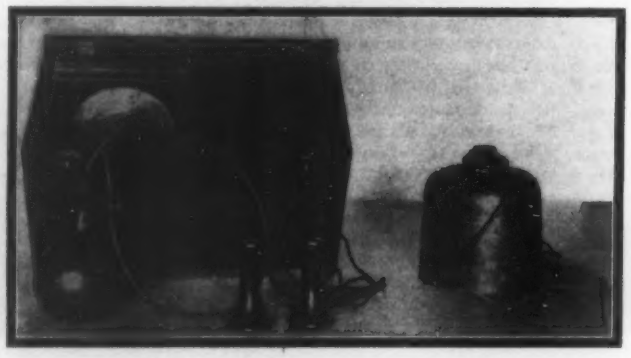
* Since this article was written by the well-known English authority the ships marked with a star have been either destroyed or disabled. The "Variag," "Askold," and "Korietz" are supposed to be beyond repair.

† These ships have armored belts.

SUBMARINE SOUND TELEGRAPHY.

Next in importance to wireless electric telegraphy through the atmosphere is sound telegraphy through water, in the establishment of communication between steamers and ships at sea.

The accompanying illustrations show perfected apparatus for the transmission and reception of bell sound vibrations through the water from one vessel to another. In our issue of February 2, 1901, we described an experimental boat designed by Mr. A. J. Mundy, based on experiments in the conductivity of sound through liquids by Prof. Elisha Gray, which was successfully tested in Boston harbor. Since then several improvements have been made under the direction of Mr. J. B. Millet, of Boston, vice-president and general manager of the Submarine Signal Company, which render the system quite complete and perfect from a practical point of view. Steamships plying between Boston and New York have been equipped with this improved apparatus, and successfully use it in signaling very frequently. Upon invitation, one of the representatives of the SCIENTIFIC AMERICAN, on a very stormy and windy night (January 18th last), took the trip from New York to Boston for the purpose of witnessing the practical working of the system aboard the steamer "Herman Winter," and noted with much interest the distinctness with which signals were exchanged when the ship was seven miles distant from the ringing bell. It is a well-known fact that sound travels faster through water or liquids than air, and this is taken advantage of in a novel and practical way.

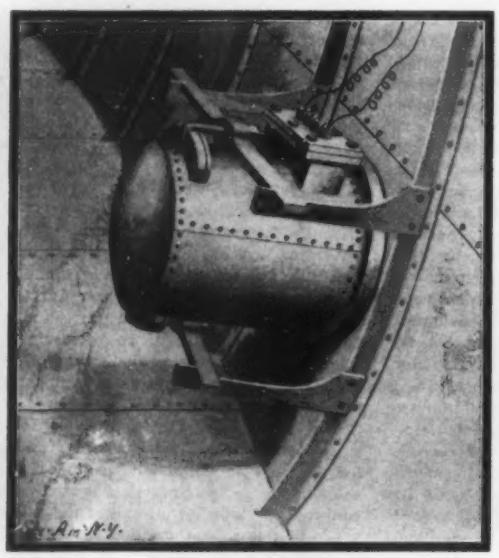


Portable Submarine Sound Signaling Apparatus.

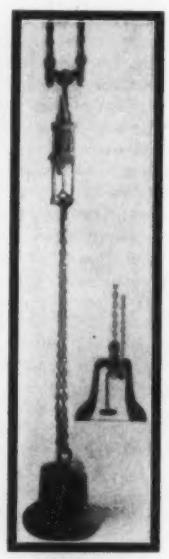
Referring to the large illustration, the circular dotted lines shown in the larger vessel represent the position in the ship of the two sound receivers, one upon each side in the hold, located approximately twenty feet below the surface of the water. The lightship "Pollock Rip" has the sounding bell hung through a well in the center of the ship, about twenty-five feet below the bottom. It also has a receiving apparatus. Beyond, at the left, is observed a lighthouse and a buoy. Depending from the buoy is a bell, with a pipe leading to the shore to the compressed-air reservoir in the lighthouse. In the small illustration the manner of suspending the bell is shown. It is held by a main chain, while a second operating chain is attached at its lower end to the bell crank of the hammer, and the upper end to a pneumatic piston, which is operated by compressed air either from the anchored lightship or the lighthouse, as the case may be, or it may be operated by a direct upward pull by manual power if desired.

It has been ascertained that the receiver for collecting the sound vibrations need not be located on the outside of the vessel, but operates as well when clamped on the inside against the inner surface of the outer hull, especially in iron ships. The sound vibration from the bell passing through the water is communicated to the side of the ship's hull, and that in turn to the liquid or water in the receiver. This, as will be noticed in the illustration, consists of a cup-shaped metal cylinder having the open end edged with rubber, and clamped against the side of the hull. Four hook-supporting arms project inward from the hull, and upon these rest two crossbars in which are hook eyebolts, the hook portion being clamped over projections on the surface of the receiver. By this arrangement the open end of the receiver is clamped securely against the side of the ship's hull, making a water-tight joint.

The Telephone Sound Receivers.



The Sound Hold-Receiver.



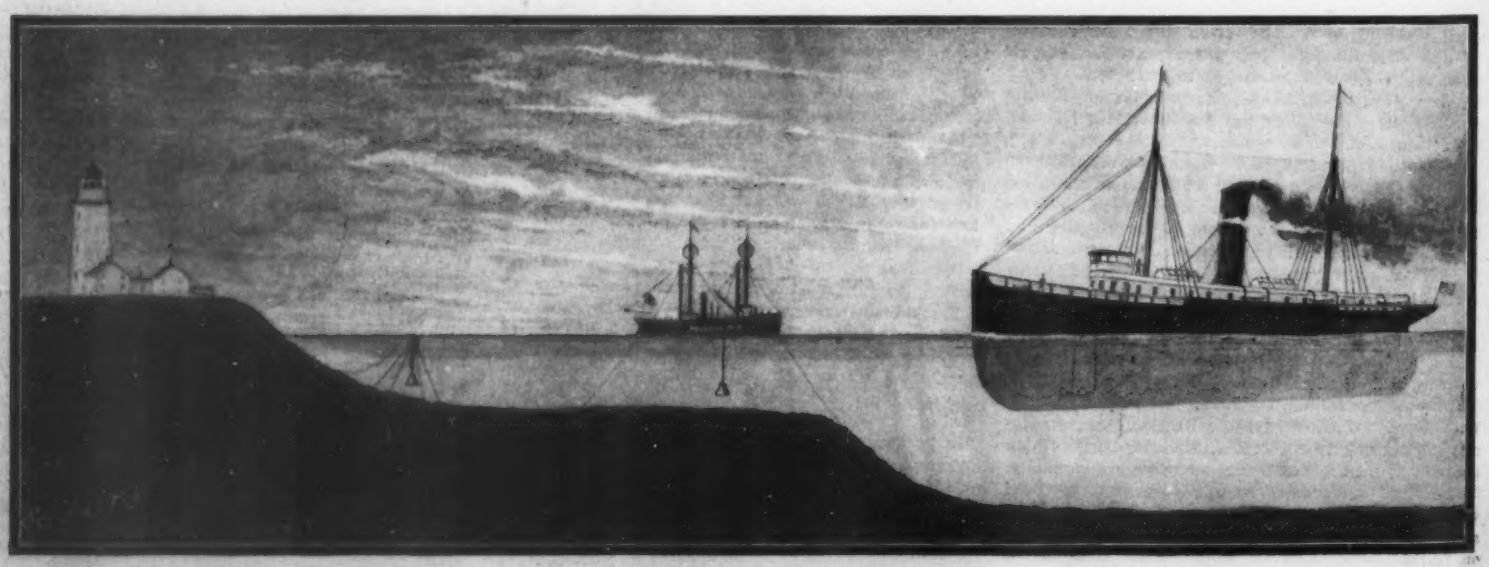
The Signal Bell.

Inserted in the top of the receiver is an electric transmitter, something on the order of a telephone transmitter, from which wires are run to the pilot house of the ship, as will be observed in one of the small illustrations. The wires are connected to a battery and the primary coil of an induction coil in the usual way, and the telephone receivers to the secondary coil.

It is obvious that when a sound impulse is given to the liquid in the receiver in the hold of the ship, it will be transmitted electrically to the telephone receiver in the pilot house. As the sound travels through the water in every direction from its source, it is found that the impulse will be stronger and louder on the side of the ship nearest to the source. By this means the direction of the sounding bell is ascertained, for by listening to the telephone receiver attached to the starboard side water receiver, and then switching over to the port side and listening to that telephone receiver, the ear detects at once which is the louder sound of the two. This was determined experimentally by turning the ship around in a large circle, when the difference in the sound from one side to the other was very noticeable, according to which side was nearer or farther away from the sounding bell. A portable apparatus for small fishing boats is shown in another illustration. The bell is shown on the right of the picture, which is suspended over the side of the boat, the hammer being operated by a separate rope. In the box is a coil of electric cable attached to a hollow water-tight spherical globe containing the electrical transmitter. This is lowered overboard with the bell, and enables two boats so equipped to signal to each other. The sound is conveyed from the spherical transmitter bulb while immersed in the water to the telephone receivers in the same manner as previously described. A depth of twenty-five feet is said to give the best results.

In foggy weather signals of this kind are readily heard, regardless of which way the wind is blowing.

Our representative, while on the "Herman Winter," observed the perfect operation of the apparatus when approaching, passing, and leaving the "Pollock Rip" lightship. It had been prearranged that the signal should be the number 73, the number of the lightship. This locality was reached shortly before daylight, yet when the ship was seven miles from the lightship, tossed by tempestuous seas, the signal, seven strokes then three, was faintly but distinctly heard. Within two miles it was quite loud, and the peculiar A musical note of the bell was plainly noticeable. It is feasible to signal words with a special code, and no doubt such a system of communication will soon be perfected. The usefulness of the system in safeguarding ships against collisions at sea at night or in a fog is evident.



SYSTEM OF SUBMARINE SOUND SIGNALING.

SAFETY HOOK PROVIDED WITH COUNTING MECHANISM

In the accompanying illustration we show an improved hook recently patented by a German inventor. It is so arranged as to automatically lock onto the article which is to be lifted, and at the same time to operate a counting mechanism. By this means the operator is relieved of the duty of counting the number of articles lifted and transported by his crane or other mechanism. When a job is completed, he can tell at a glance just how many operations have been performed with the hook. The hook consists of a hook-shaped casing, to the front end of which the hook proper is pivoted. A spiral spring normally holds up the rear end of the hook, causing it to occupy the position shown in full lines in our illustration. When a load is suspended on the hook it causes the hook to swing on its pivot to the dotted position shown, thereby closing over the cable or other means of attachment to the load. With the hook in this position it will be observed that the weight of the load is carried by the casing, and the hook merely acts as a guard to prevent the load from slipping off. In order to prevent the device from accidentally opening, a locking lever is provided, which snaps over the rear end of the hook when it is in its lowest position. This lever may be moved out of engagement with the hook by pressing a stud at the upper end of the device. The counting device is shown at the left of the device, and is operated by the hook, which, when in its lowest position, depresses a pin on the counting attachment, and registers either with a printing device or a pointer swinging over a dial.

SAFETY HOOK PROVIDED WITH COUNTING DEVICE.

Underground vs. Overhead Telegraph Cables.

Owing to the widespread havoc that is wrought to the overhead telegraph wires of the British Post Office laid through the midland and northern counties, through gales, often causing a serious dislocation of business, the government decided to test the advantages of a subterranean cable as a solution of the difficulty. The first section was laid three years ago between London and Birmingham. During the whole time this cable has been in use there has been no defect or derangement of working, though the overhead wires north of Birmingham have often been broken down and the business centers of Liverpool and Manchester have been quite isolated from London. Owing to the serious inconvenience thus caused, and the satisfactory working of the London-Birmingham cable, a scheme is now being carried on by which all of the overhead wires extending across exposed weather zones are to be supplanted by underground cables.

An experimental cable was at first continued from the Birmingham end of the London cable as far north as Warrington. It was subjected to severe trials, and these were so satisfactory that now this experimental cable is being pulled out and a permanent trunk cable is being installed.

The cable is being laid in a 3-inch cast-iron pipe. It consists of 103 wires inclosed in a leaden sheathing. Seventy-four of the wires are twisted in pairs and the remainder are single wires separately wrapped with a tape of copper for the purpose of screening the wires from inductive action. The pairs of wires may be used for telephonic purposes, but their primary use will be for high-speed telegraph circuits. The necessity for double wires for the latter is to reduce capacity of the wire. When the capacity of a wire is increased the speed at which it is possible for a circuit to be worked is decreased. Underground wires have very much greater capacity than overhead, but by using another wire for the return path instead of the earth, the speed of a circuit can be considerably increased.

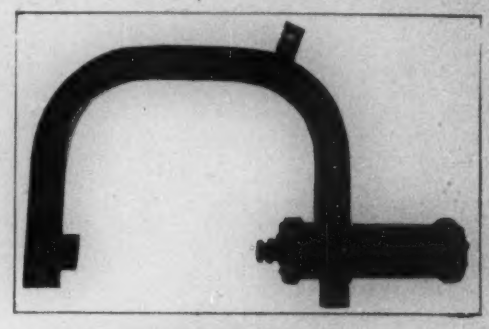
The route from Birmingham is *via* Walsall, Cannock, Stafford, Eccleshall, Woore, and Nantwich. At the present time the cable has been completed to Eccleshall. The whole of the cables have been pulled into pipes, but between the last-named place and Nantwich the lengths of cable still require to be joined together.

It is anticipated that the cable will be carried to Warrington before the end of March. At Warrington, lines connecting Liverpool and Manchester will be tapped. It will then be possible to work from London to those cities by means of underground wires.

When this scheme is completed it is proposed to continue the cable to Carlisle so that there will be a continuous underground trunk cable, free from interruption, direct from London to the extreme north.

A POWERFUL COMPRESSED AIR CLAMP.

The value of compressed air in submarine work is being appreciated by the invention of various kinds of mechanism which is operated from above the surface of the water, the air being supplied through hose connections just as it is furnished the diver. The accompanying photograph shows a device which is utilized in crib-work and other submarine construction. It is really a gigantic grip of steel, which is employed for holding timbers together temporarily until they can be bolted into place. The grip is usually handled by a crane, and when in position the end opposite the cylinder is submerged, being adjusted beneath the timber to be held while the cylinder end is placed above. Merely by turning a valve, the compressed air forces the piston of the cylinder against the timber and clamps it securely until the bolts can be adjusted, when, by relaxing the air pressure, the piston is released, and the grip can be at once moved to another position. By using this apparatus the services of a diver can be frequently dispensed with, while it also avoids considerable other manual labor.



CLAMP OPERATED BY COMPRESSED AIR FOR SUBMARINE WORK.

A WATER SHADE.

NOVEL APPLIANCES FOR FIGHTING FIRE.

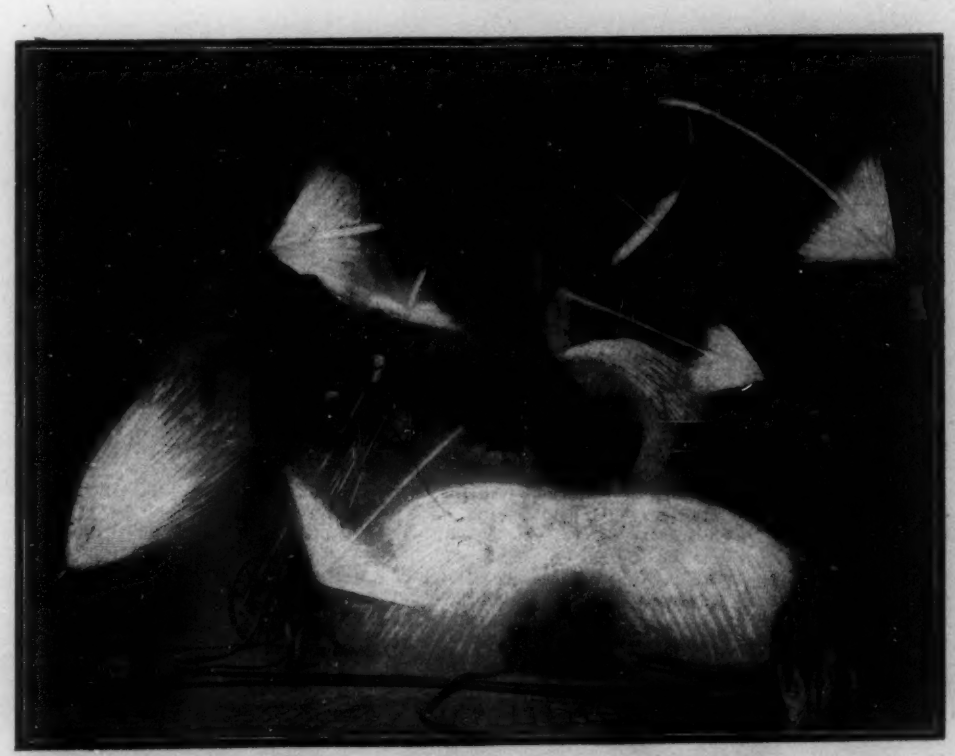
One of the main characteristics which differentiate man from the lower animals is his ability to produce fire. Just how early in the existence of the human race this ability appeared is not clearly known, but it is certain that primitive man had not acquired it for a considerable period.

Having once obtained the power of producing combustion at will and of keeping it up for an indefinite time, fire became perhaps man's greatest friend, and surely a highly important adjunct to his ultimate civilization. Yet when this mighty destructive force is uncontrolled, it becomes a most potent and dangerous enemy, scarcely less to be dreaded than a plague.

Of this latter truism history has not been wanting in examples, and we ourselves have only recently had two most appalling exhibitions of its power for destruction. Methods and means for fighting and conquering this dread enemy to human life and treasure, occupy the minds of experts continuously. For small and relatively unimportant conflagrations, acids giving off heavy and non-combustible gases are found efficient, but where the surface attacked is not circumscribed within narrow limits, this will not do, and recourse must be had to water, the greatest extinguisher of fire, and at once the most abundant and easy to provide. How to apply water in the most effective manner has long been the problem.

Close proximity to the fire is requisite to overcome it; but there is no fierce fire which does not supply intense heat and blinding smoke in large quantities, and these are the greatest obstacles which the fire fighters have to combat in their efforts to rescue life and property. Numerous expedients have been resorted to for enabling them to do this with comfort and safety; and we take pleasure in placing before our readers the mechanical contrivance recently exhibited by the fire department of Charlottenburg, near Berlin, for the illustrations of which we are indebted to the Illustrirte Zeitung.

To protect the fireman from the wall of flame and dense cloud of smoke, while at the same time enabling him to play water upon the burning building, is the main object of the invention. The pictures are from photographs recently made in the courtyard of the Charlottenburg fire station, and they present a realistic view of a fire fought from behind the watery protection afforded by the new appliance. In the larger pic-



FIREMEN EMPLOYING THE SWIFT NOZZLE, SHOWING HOW WIDELY THE STREAM CAN BE DIVERGED.

ture, the various working effects produced by the Swift nozzle are patently shown.

The Swift nozzle has a simple annular mouth-piece, which is about 2 centimeters back of the stream exit, and situated behind a collar cast upon the nozzle itself. The walls of the latter are perforated to the interior, and over these perforations, for the purpose of deflecting the issuing water, a beveled sleeve is threaded. The screwing in or out of this sleeve produces the variety of protective screens shown in the cuts. The contrivance is very simple, easily manipulated, and its degree of efficiency is amply demonstrated. The larger picture shows eight firemen in the act of attacking a flaming structure, from which issues huge volumes of smoke. The degree of the deflection of the secondary stream is shown to be from a wide spray thrown upon the burning building to a conical spray protecting the fireman and yet projecting forward, to an almost flat circular disk of water, which beats back the smoke and heat from the advancing man. Again, under a protecting canopy of water, a man almost asphyxiated by smoke is being resuscitated.

In the smaller picture, a combination of the Swift nozzle with the smoke hood and speaking apparatus is shown. Provided with oxygen to breathe and a veil of water to keep back the heat, the man can enter most dangerous places, and, by reason of his ability to communicate with his comrades without, can keep them informed as to the progress of the work within. By means of the Swift nozzle he can, as occasion demands, extinguish the flames with a wide-spread spray or a powerful and well-directed solid stream.

The smoke hood in use here is the invention of Herr König. It consists of a sort of diver's hood provided with glass eyes and valves for the exit of the air, which is pumped into the hood through a wire-bound tube or hose attached to the fireman's waist and carried up his back to the entrance into the hood. König's mode of speaking to the men outside was effected through the column of air in the tube, but this has been improved by running a fine telephone wire throughout the length of the hose, connecting a microphone speaker opposite the mouth of the operating fireman with a receiver at the engine or pumping station. Three men are necessary for the effective employment of this combination—one to do the work in the face of the danger, one to look after the air tube and life line attached to the first, and one to attend to the phone and the water hose leading likewise to the first. Sight must not be lost of the fact that though apparently well protected by this apparatus against the dangers of asphyxiation and burning, the movements of even the strongest man cannot fail to be hampered by the added weight of the waterproof clothing, not to mention the burden of the hood and extra hose. An element of danger lies also in the attachment of the parts to his person. Precipitous flight would be out of the question.

A man without apparatus could simply drop his hose and flee in any direction where danger seemed less aggressive, whereas a man provided with these safeguards must needs retrace his steps the way he came, carefully avoiding entanglements, or perish.

Again, there may be doubts where such powerful pumps as we employ are used, which require several men to hold a nozzle, whether such contrivances would be applicable. Could a man stand up under them? Hardly; and yet much may be learned from them. Perhaps we do not need all the water we throw upon a burning building; perhaps fewer and better directed streams would suffice to quench the most stubborn fire.

Suggestions such as these may be worthy the consideration of the greatest fire department the world has ever known. That fires occur and prove destructive is not the fault of a most excellently equipped fire department, but of the building laws. The writer lived seven years in the city of Vienna, Austria, and only witnessed three fires in all that time, two of which were theatre fires—the Ring Theatre being one—and the third the roof of a dwelling or large apartment house. Though water is plentiful there, and at high pressure, little is thrown upon the burning structure. Even at the Ring Theatre, orders were soon given to stop the water, so that the foundations might not be undermined and the walls fall in; and though the building was gutted and smoldered for a week, with the exception of some smoke around the upper windows, a little broken glass, and the absence of the roof, no traces could be seen of the fire from the street, while as for the roof fire, the destruction got no further than the top floor.

The big flagstaff of the House of Hoo-Hoo has reached the World's Fair grounds. The timber is 60 feet long and 12 inches in diameter at the base. The House of Hoo-Hoo is built entirely of wood and is intended to form a museum of the lumber products of the United States as well as a handsome club house for lumbermen.

Engineering Notes.

A pamphlet has been published by the Austrian War Ministry concerning the utilization of bronze, instead of steel, in the manufacture of heavy guns. Austria is now the only country which employs bronze as the material for its heavy cannon, and it is the intention of the government to retain it. This official pamphlet states that this bronze, forged according to a secret process, is equal to nickel steel. Moreover, the cost of the inner tube is three-fifths less than that of the steel tube. Another advantage is that an injured bronze gun can have a new jacket fitted to it, which is difficult with a steel one. Lieutenant Field-Marshal Uchatius, who in the seventies discovered a special process for forging bronze, also found that good homogeneous bronze could be hammered in a hot or cold state, and therefore can be improved in quality. Lieutenant Field-Marshal Frederick Thiele, the present director of the Vienna Arsenal, also obtained very favorable results in forging this metal, producing a kind of bronze not surpassed by the best cannon steel, through a combination of metals, careful alloying, and judicious rolling.

At the works of the Yarrow shipbuilding firm of London, interesting experiments have been carried out concerning the ratio of the grate area to the heating surface of boilers. This is an important consideration, as upon this proportion depends to a very appreciable extent the efficiency of the boiler, especially if it is of the water-tube type. For the purposes of these tests a water-tube boiler equal to 1,200 indicated horse power was employed. This boiler had 1,008 tubes, each 1¾ inches outside diameter, with an average length of 6 feet 9¼ inches. The test was conducted with a boiler having 53 square feet of grate, and with 3,217 square feet of heating surface, giving a ratio of 1 to 60.7. In the second test the grate was reduced to 40 square feet, with a slight change in the heating surface, giving a ratio of 1 to 78.2. The results showed that there was a much higher evaporative efficiency with the smaller grate. Each pound of fuel consumed gave with the small grate 10.57 pounds of steam, while in the other case it only gave 9.96 pounds. But it was also decided that irrespective of this, the same boiler should give an equal volume of steam, and thus the quantity of coal consumed per square foot of grate had to be increased. For instance, with the larger grate the rate was 29.7 pounds of fuel, and with a less area 39.31 pounds. To burn the greater quantity more draught was required, 0.75 inch as compared with 0.56 inch. These results are highly valuable, for the greater efficiency of the small grate would reduce the fuel consumption on a vessel to a very appreciable extent. The explanation of this greater efficiency is that the gases of the fuel are consumed more quickly, and are not so likely to come into contact with the cold surfaces of the tubes in an unburnt state.

It is stated that an American syndicate has proposed to the Russian government to construct a canal from the Baltic to the Black Sea for the sum of $160,000,000, which is one-third less than the estimated official cost. The junction of its great northern and southern seas by a navigable estuary of sufficient width and depth to permit of the passage of men-of-war and ships of great tonnage has long been a favorite project in the councils of the Czar. At the present stage of the undertaking there are two, and only two, plans of procedure. One is to utilize the existing Beresina Canal by widening, deepening, and generally extending it, and the other, to adopt a perfectly new route altogether. According to the Uhland Verkehrszeitung, the plans of the canal have been recently deposited with the Minister of Ways and Communications, in which the proposed new route has been minutely and fully defined. The canal will commence at Riga, which, next to St. Petersburg, is the most important of the Baltic ports of Russia. It will avail itself, wherever practicable, of such portions of rivers, canals, and other waterways it may meet with in its course as can be made to profitably contribute to the success of the whole undertaking. For 125 miles it will absorb a part of the channel of the Divinea, as far as the fortified town of Dunaburg. Thence it will run through a deep straight cutting 100 miles long, and join up with the river Beresina at Lepel. From this point it will follow the canalized river to its junction with the Dneiper, and use the latter stream for the rest of its course to the Black Sea at Kherson, to the west of the Crimea, near Odessa. From the one sea to the other the distance will not be less than 1,000 miles by the new scheme of inland navigation. The cost of construction, according to the offer made, would amount to $160,000 per mile, which is not an unreasonable price to pay. In addition to the value of the canal as a considerably cheaper route for the transport of goods, it would in war times possess a strategic importance probably exceeding that belonging to the "Kaiser Wilhelm" waterway. It is calculated that Russian armorclads could thus navigate the kingdom from sea to sea in half a dozen days.

Electrical Notes.

The first part of the new German Atlantic cable between Borkum and New York has been completed, thus fulfilling the conditions under which the German government placed the German Atlantic Telegraph Company in regard to the laying of the cable. The section completed is that between Borkum and the Azores. Under the agreement between the government and the company the latter will receive a sum of £35,700. The second part of the cable between the Azores and New York, which will complete the line, is to be laid by the end of the current year.

Owing to differences of opinion between the state, the municipal authorities, and the owners of the Tuileries Garden in Paris, the electric lighting of the garden has been much delayed. The main question in dispute, as to who should direct the work, has, however, now been settled in favor of the state, and although the city engineers are actually conducting the operation of laying the wires, it is under the superintendence and direction of the government. The type of lamp decided upon by the latter is known as "Arc Nouveau," and is far finer than that proposed by the city. The lamps will bear comparison with the four beautiful standards which now adorn the four corners of the Place de la Concorde, or with those others, different but equally handsome, around the Opéra.

The Electrical Engineer (London) stated a few weeks ago that it is Mr. Marconi's intention to make a test of his wireless telegraph system at long distances overland. So much of his experimental work has been carried out between coasts, that it will be refreshing to watch the performance of the system across country. For this purpose Mr. Marconi is erecting a station at Fraserburgh, in Scotland, with a view to establishing communication with his Cornwall station at Poldhu. The Scotch station, however, will also be used for communication with ships, and it is ultimately intended to establish communication between the North of Scotland and Iceland. Mr. Marconi is now at Fraserburgh, but will shortly cross the Atlantic on a visit to his wireless telegraph installations on the St. Lawrence River.

The Osiris prize has been divided between Madame Curie, in recognition of her part in the discovery of radium, and Prof. Branly, inventor of the system of wireless telegraphy which bears his name. The prize is worth $20,000, and was offered by M. Osiris in 1900 for any work which should be deemed useful for mankind by the members of the Syndicate of the Paris Press. The prize remained undistributed until it was recently suggested by the founder that the claims of the Curie family should be considered. It was then decided that Madame Curie and her husband should receive $12,000, and that the remaining $8,000 should go to Prof. Branly. The ceremony of presenting the respective amounts took place in Paris recently, when the hope was expressed on behalf of M. Osiris that Madame Curie would be able to continue her researches in the interests of science.

The illumination of the outside of the buildings and grounds at the World's Fair to be held at St. Louis this year will probably be the biggest piece of work of its kind that has yet been carried out. The contract provides for 300,000 incandescent lamps. These lamps are for lighting the exhibit places, grounds, and architectural features of the exposition proper, and do not include those for state, national, and private concession buildings. To give an idea of the distribution of the lamps, it is stated that 12,000 alone are to be placed on the Palace of Education, which building furnishes an excellent setting for night effects produced by the electric light. The illumination of the grounds is to be carried out on very ambitious lines. Each monumental standard will carry 24 incandescent lamps, so distributed that 12 will hang on each arm of the supporting post. The lighting of the inside of the buildings will be accomplished entirely with arc lamps.

Mr. H. B. Ford, of New York, has patented the construction of a zinc amalgam electrode for use in secondary batteries. According to the Electrical World, he fills a thin porous wooden cup partly with mercury and places into it a thin copper plate plated with zinc and corrugated in a vertical direction. For the other electrode he uses a copper plate covered with peroxide of manganese. As electrolyte, dilute sulphuric acid of 25 deg. Baumé is used. The charging current causes the mercury to act upon the zinc and copper plates in the usual way, and also forms by the absorption of hydrogen a mercury sponge containing also some zinc, which expands upwardly until (if the preparations be correct) the porous cup is practically filled. In the discharge of the battery there is double action of the oxygen upon the zinc and upon the absorbed hydrogen respectively. The action upon the hydrogen is first completed, resulting in the disappearance of the sponge. So long as the latter remains the voltage is about 2.5. Upon its disappearance the E. M. F. drops to about 1.5 volts.

Correspondence.

Theatre Isolation.

To the Editor of the SCIENTIFIC AMERICAN:

In the various communications that have appeared both in the columns of your valued paper and in other technical journals regarding the terrible loss of life in the Iroquois fire, sufficient stress has not been laid upon the subject of theatre isolation. If theatres were constructed as detached buildings, the fear of panic would be reduced to a minimum. Every theatre should be built entirely isolated, and also it should be used for no other purpose; as often built we find stores and offices occupying the front part of the theatre where a fire might gain considerable headway before it was noticed, and where the audience would have to escape by passing the flames. If separated by a distance of, say, thirty feet from all other buildings and surrounded on three sides by outside galleries or balconies at least seven feet wide, projecting from the face of the wall and supported on cantilevers, a place of refuge would be afforded the audience in case of fire, and the audience would gain a feeling of safety which would greatly reduce the danger of panic. There should be broad windows, glazed with common glass, opening on the different galleries, which would make them readily accessible at all times; windows would be preferable to doors, as the glass could readily be broken, even if the windows were locked. The government, in the case of its post-offices, enforces a rule to the effect that a space of forty feet must intervene between its buildings and the nearest adjoining structure. Our municipalities should certainly be able to enforce a similar regulation, and it would certainly greatly reduce the danger from panics. Many of our cities rule that a certain specified space must separate theatres from other buildings, but the trouble is often that they are not enforced. We make good rules, but the enforcement of them is too often neglected. Violations of theatre ordinances would be very infrequent, instead of the reverse as at present, if a heavy penalty were inflicted. An ordinance without a penalty is almost useless, as experience proves that the theatre managers and building inspectors will become careless as long as the general public do not care whether the rules are enforced or not.

JOHN A. WALLS.

Los Angeles, Cal.

Boiler Scale.

To the Editor of the SCIENTIFIC AMERICAN:

I was surprised to see in the last issue of your paper an article on "Boiler Scale Detection" in which the statement was made that "The reason for the presence of boiler scale has never been explained satisfactorily, although a great deal of time has been spent by scientific men in an endeavor to solve not only the mystery of its origin, but to arrive at some means of preventing the deposit."

Allow me to say that I think this is very inaccurate; since the presence of scale *has* been satisfactorily explained, its origin is *not* a mystery and there *are* adequate means of preventing the deposit.

The explanation of the presence of boiler scale is very simple and familiar to almost every chemist. In the first place, nearly all natural waters contain among other things, a certain quantity of salts dissolved in them, the amounts of these constituents varying in different waters. For instance, water is said to be "hard" when it contains an excess of calcium or magnesium carbonate dissolved in it in the form of bicarbonate. Likewise calcium sulphate (gypsum) is found in nearly all water. These substances of course all come from the erosion of the rocks and minerals with which the water comes in contact. But the problem is not so much how they come into the water as how to dispose of them after they are there. It has been found by chemical analysis that Croton water, which is fairly pure, contains the carbonates of calcium and magnesium to the extent of about 4 grains per gallon and over 1-10 of a grain of calcium sulphate. While these figures seem insignificant at first, when we consider that there are 58,318 grains in a gallon, it must be remembered that millions of gallons of water are used in a boiler. Assume, for example, that a million gallons are used; the 4 grains becomes 4,000,000 grains (150 pounds avoirdupois) and the 1-10 grain becomes 100,000, or 14¼ pounds.

The principal constituent of boiler incrustations is gypsum, which upon the evaporation of the water holding it in solution, deposits upon the sides and in the tubes of the boiler as a refractory, largely insoluble, and intensely adherent coating. This by contact with the red-hot iron of the boiler becomes baked as hard as stone and acts as an insulator to the inside of the boiler, preventing the heat from reaching the water. Hence it is necessary to make a hotter fire, thereby wasting fuel and injuring the boiler, which was not constructed to stand this treatment and which will blister or flake off as oxide of iron.

There are several ways to prevent the formation of boiler incrustations, the best being the use of distilled water with the employment of a condenser. This plan has been adopted on board large steamships and has not only the advantage that no crust forms, but is economical, since the same water may be used successively for an indefinite period. If, however, distilled water is objected to as too expensive, there are several makeshifts of considerable practical utility. For example, a preparation of barium chloride, ammonium chloride and logwood sawdust will prevent cake from forming on the inside of boilers. The reason for this is that the barium chloride reacts with calcium carbonate and sulphate to form barium carbonate and barium sulphate, which are not adherent and readily settle round the sawdust as a nucleus. The ammonium chloride prevents the precipitation of the magnesium as a carbonate. Perhaps the most important step in connection with the use of this crust preventive is the drawing off of the water after using the boiler for a time and thus removing the accumulated precipitate contained in it. If these precautions be observed, there is really no reason why any large quantity of caked gypsum or other deposit should form upon a boiler.

I hope that you will not allow the erroneous impression to remain, that boiler scale is a necessary evil, foreordained by the gods as the everlasting companion of all boilers, good, bad or indifferent.

DUDLEY H. MORRIS.

[Our contributor's statement of the difficulty of ascertaining the origin of boiler scale should not be taken too literally. The article alluded to concerned itself chiefly with the detection of boiler scale and described an ingenious instrument for measuring the actual amount of such incrustation.—ED.]

The Carrier Pigeon for Newspaper Service.

To the Editor of the SCIENTIFIC AMERICAN:

In a recent number of the SCIENTIFIC AMERICAN I note the record you give the reporter of the Newark Times for pigeon service from the yacht races. Now, with the exception of the developing of the picture on the press boat, the record made by the Times has been beaten several times by my old paper, the Milwaukee Journal.

The Journal was the first western paper to use carrier pigeons, and it has made excellent use of them in reporting steamer excursions, State and county fairs, athletic contests, and other events within a radius of seventy miles of the office. The best time record was made at the State fair of 1901. At that fair, as well as at three others, I had charge of the reporting work, and dispatched five to seven columns of copy a day by bird. At that fair, at 2 o'clock in the afternoon, the dog show judge awarded the first prize in the terrier class, and Mr. W. W. Rowland of the staff obtained a mounted photograph of the winner a few minutes afterward. We stripped it from the mount, rolled it in a carrying cylinder, and dispatched a bird with the print and the news of the event. It left the fair ground at 2:20 P. M., and flew the seven miles to the coop at the office. The print was detached and sent to the cut shop, and at 4 P. M. the paper with the news and the cut was on the street. We sent plain news, machine set, so as to have it on the street thirty minutes after being dispatched.

We frequently had news dispatched from thirty miles away on the street in ninety minutes. The best long-distance record was made in October, 1900, when we took a large number of birds to Chicago to report a steamer excursion. This event will be remembered by many of your readers, as it was the annual excursion of the National Wholesale Druggists' and Proprietary associations. We left Chicago at 9 A. M., and dispatched birds every hour from twenty miles offshore, the first from off Fort Sheridan, the last about two miles off the Milwaukee harbor piers. When the steamer landed at the dock in Milwaukee, about an hour afterward, the newsboys were on the dock with the paper containing the complete record of the trip.

We made many other good records with the birds, beating the telegraph or telephone on the amount of copy used.

CHARLES W. LAMB.

Menasha, Wis.

The Meaning of the Word "Torque."

The word "torque" is so frequently used nowadays, that it may not be out of place to give here a brief explanation of its meaning. To those who are familiar with electric motors the term is clear enough, but to many amateurs it may not be without interest to know just what the word means. The best explanation which we have seen is the following from Railway and Locomotive Engineering:

The word "torque" comes from a Latin word meaning to twist, and it may be defined as the twisting or turning effort imparted to a shaft carrying the revolving armature of an electric motor. The torque of a motor such as is used to drive a street car or to run a machine tool in a railway repair shop may be found by experiment. A lever tightly clamped to the shaft is of such length that its free end may be supported upon the platform of weigh scales, exactly one foot from the center of the shaft. As soon as the current is turned on, the end of this one-foot lever resting on the scales will press down a certain amount and register what is equivalent to a weight. For the sake of example, suppose the scale registered 4,000 pounds under the circumstances. The torque of this motor would therefore be 4,000 foot-pounds because the pressure exerted by the lever had been measured one foot from the center of the shaft. Continuing the experiment, let us suppose that the lever has been removed and that a pulley has been keyed on the end of the shaft in its place, and further suppose the radius of this pulley to be 12 inches, and that it carries a belt which gives rotation to some other pulley. The torque of the motor remaining the same with given current it follows that the pull on the belt, like the weight registered on the weigh scales, will be 4,000 pounds. Torque is, however, always expressed as foot-pounds. The pulley we have been considering had a radius of 12 inches, or in other words, its diameter was 2 feet. Now, if a pulley 4 feet in diameter was to replace the smaller one, we would have this new condition. The torque being constant with constant current, the pull on the belt would now be 2,000 pounds.

As the torque is found by multiplying the radius of the pulley in feet by the belt pull in pounds, it rests with the designer to make the pulley or car wheel, as the case may be, the size best suited to the work to be done. Torque is practically equivalent to the tractive effort of the motor if mounted on wheels 2 feet in diameter.

When the speed of the motor is considered, the horse power may be determined. As the motor revolves a certain number of times in a minute it follows that a definite number of foot-pounds of work must be delivered in that time. If the speed be such that the belt pull would be equivalent to the raising of 33,000 pounds one foot high in a minute, the motor would, under those circumstances, be developing 1 horse power.

Improved Car Fender.

During the fifteen years that the electric street railways of the country have been increasing in size and number there have been many attempts to produce a car fender the front edge of which would always remain close to the track under all conditions of load. Particularly is this true when the added requirements of effectiveness, cheapness, durability, and simplicity had to be met. So great has been the dissatisfaction in regard to fenders that one writer proposed the doing away with the single-truck cars and proposed the use of the large double-truck cars, which, it was thought, would hold the fender in a much better position; but this conception was probably caused by the fact that the large double-truck car bodies move up and down much more slowly than car bodies on single trucks, so that the motion is not so noticeable. The fact is that both the large or double-truck cars and the small or single-truck cars need a self-adjusting device so as to keep the fender in a proper position however the car body may rock or be tipped by an uneven load.

Alexander Otis Lamson, of Bridgeport, Conn., has recently received a patent on such a fender. The adjusting mechanism is located between the car body and front and rear journal boxes and is so proportioned that when the car body is tilted endwise the fender automatically adjusts itself to meet an increase or decrease in the load at either or both ends of the car. As there is but little motion to the mechanism the durability is correspondingly great. Each end of the front edge of the fender may be automatically adjusted by separate devices on each side of the car so as to keep it level and at a fixed height when the car is tipped sidewise, provided the fender be flexible.

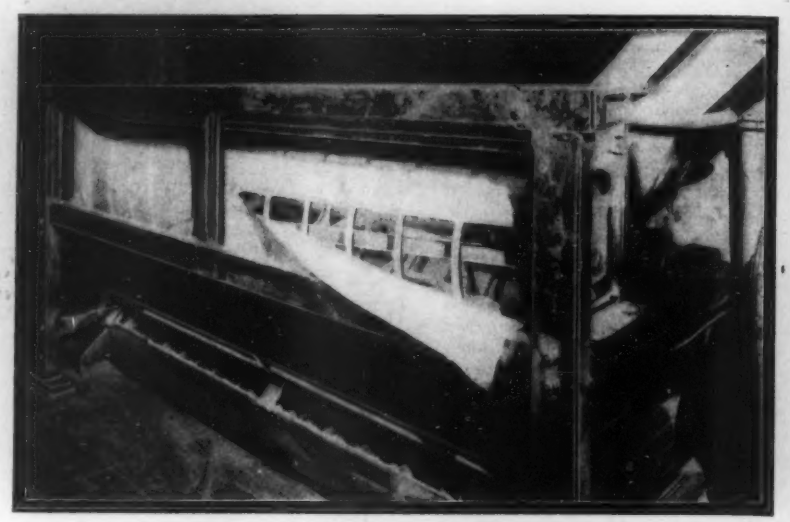
Two New Japanese Battleships.

The Japanese government has placed contracts for the construction of two battleships with the English shipbuilding firms Vickers, Sons & Maxim and Sir W. C. Armstrong, Whitworth & Co., respectively, to be built and completed for war service. These vessels when completed will be the most powerful fighting ships extant. They will have a displacement of 16,400 tons, and steam about 19 knots. Their main armament will comprise four 12-inch guns in the two main barbettes, and they will have heavier secondary guns than have ever been adopted before in warships. The machine guns will also be more numerous. From the main artillery each vessel will be able to discharge eleven tons of projectiles per minute. The system of armor distribution will follow the lines introduced in the previous ship built for Japan at Barrow, the "Mikasa," the whole broadside of the citadel being armor-clad. Each vessel will cost about $6,250,000 and is to be ready for service within eighteen months, the shortest period that has ever been allowed for the construction of a war vessel of such dimensions.

MODERN FLOUR MILLING.

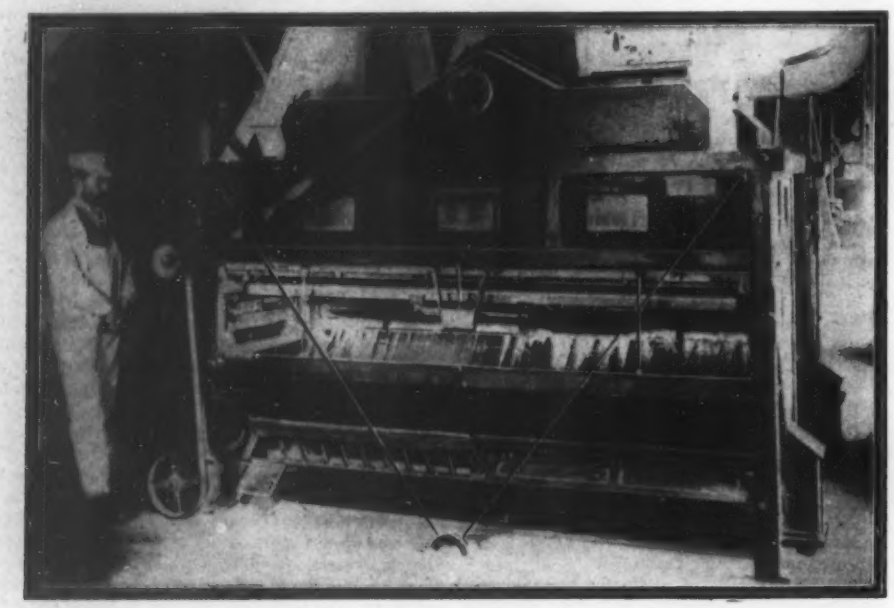
IF it were asked what is the commonest article in daily use, the answer would be "bread;" and its supreme importance is indicated by the fact that in all ages it has been considered as the symbol of food. The milling of cereals is of great antiquity, and it is to Egypt, that great granary of the ancient world, that we owe the manufacture of flour, which was first brought to comparative perfection in the Nile Valley, and we know that in Roman times it was the great center of the world's supply. Strange to say, it is only within the memory of those still living that any substantial improvement was made.

Having described in several articles the wheat farms of the West, where the most powerful agricultural machinery in the world is at work, it is time to consider how the vast acreage of wheat is made useful to man by producing a manufactured article—flour—from the raw material—wheat. We have selected the largest mills in the world, those of the Washburn-Crosby Company, of Minneapolis, Minn., which have a daily capacity of 30,000 barrels of flour, consuming 125,000 bushels of wheat a day, or over 135 carloads, the product of 10,000 acres, or 15 square miles. Before beginning the consideration of the somewhat complicated subject of milling, it would be well perhaps to consider the grain of wheat in the abstract, and the real nature of flour, concerning which there is much misinformation. Wheat is sown early in the year, as it is a peculiarly hardy grain, thriving even in the cold Northwest. The seed is forced into the plowed and harrowed ground by a "seed plow," and in a short time the germ in the kernel begins to vitalize, and shortly we see the small green shoot, indicative of the round of nature's processes. From April to August its young life is menaced by many dangers, but it is hardy, and battles with its foes—heat, cold, humidity, and insects—until at last it ripens and invites the sharp snip-snip of the reaper and binder. The threshers follow, separating the beautiful kernels from the yellow straw, thus reducing an enormously bulky crop to one which can be easily stored and transported by mechanical means at low expense. It is retained in elevators or sent directly to the mill. All wheat is not worth the same price; some farmers allow the tares to grow up, and stunt the rugged growth of the grain, or other kernels may become mixed with it. The chemist now comes in and analyzes the samples, and decides what shall be bought and the "market" fixes the price.



Bolting Reel for Separating the Flour from the Bran.

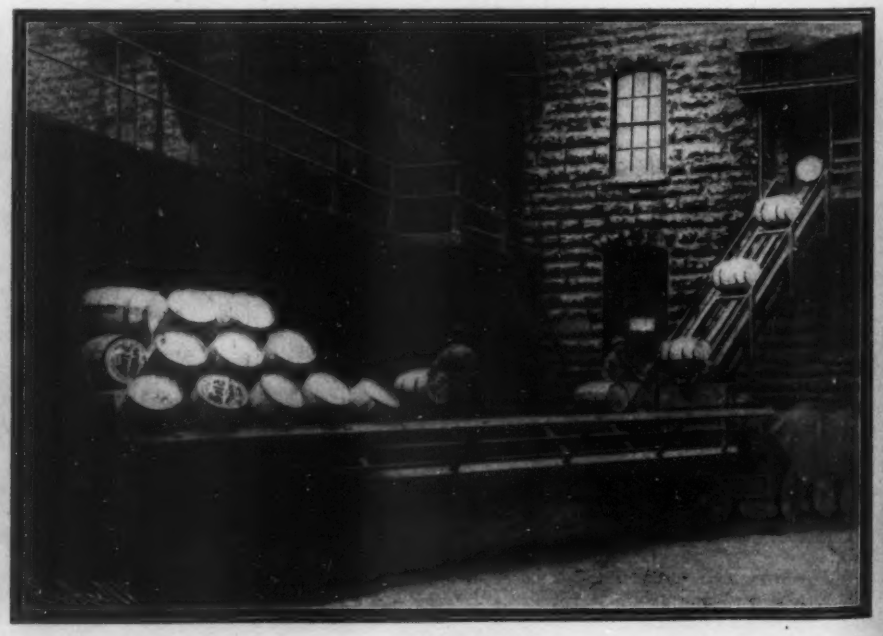
The great elevators, which we have already described, may store the grain of thousands of farmers, but sooner or later the carefully-graded kernels arrive at the mills in carloads containing 700 to 1,200 bushels each. The grain doors are torn down, and with the aid of steam shovels it is precipitated into a chute, whence it is transported to the top of the mill, where it is weighed in large hopper scales by a deputy State weigher. It is then elevated into storage bins, where it is blended to secure an absolutely uniform product.



Middlings Purifier for Taking Impurities from the Crushed Grain.

Now the wheat grain is peculiar, and is more complex than is generally supposed. Its outer hull or cellulosic coat is composed of five layers, and beginning with the outside is known as the epidermis, epicarp, endocarp, testa, and inner coat of bran. Leaving these botanical considerations to the botanist, the miller takes upon himself the entire separation of these coats from the inner starch and gluten producing cells inclosed. The "germ" is useful as a breakfast food, but not for milling, as it impairs the keeping qualities of the flour. Besides the starch cells there are gliaden and glutenin cells; the latter two when combined with water form gluten, which gives the flour much of its value as a food. The milling processes must now remove the bran coats and crush the gluten and starch to a soft powder of great fineness, and this is only accomplished by a series of operations which are interdependent. At this point, however, it might be well to call attention to a popular error. Flour is not dust or pulverized wheat; it really consists of *sharp* granules of uniform size, composed of starch and gluten, all impurities having been removed. The thought might arise as to what is known as "whole wheat" flour, which created such widespread interest a few years ago, on account of its alleged great nutritive value over white or "patent" flour. It is perfectly true that the germ and bran have food value, and if the human stomach were capable of performing all the operations of the miller, this could be utilized. There is more nutriment in the skin of the potato than in the body of it, but who can eat an equal weight of the former without the stomach's rebelling? A nutritive substance is not always a digestive one. We give flour to men and women and bran to cattle, and all thrive, but a man is no stronger than his stomach. Milling is not done to make a white flour, but to make a food product which will be easily assimilated. We left the graded and blended grain in storage bins. It

Bran Dusters.



Unloading Barrels.

MODERN FLOUR MILLING.

now goes into a separator, which in brief consists of two sieves of perforated metal, those in the upper one being large enough to allow the wheat to pass through, while the largest seeds, such as barley, oats, etc., which are larger than the wheat, are retained as "screenings." The perforations in the lower sieve are smaller than the wheat kernel, so that all the small seeds, such as wild buckwheat or mustard seed, can pass through, the wheat being retained. The wheat then passes into a scourer, which consists essentially of a perforated cylinder, inside of which are beaters revolving rapidly around a vertical shaft. The wheat being fed in at the top is caught by the beaters, and brushed against the cylinder.

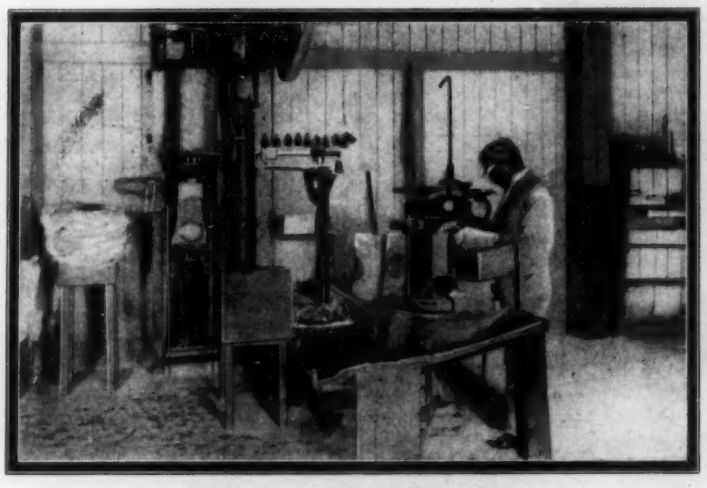
In order to get the grain to a uniform temperature, it is run through wheat heaters, which are of several types, the wheat passing over coils heated by steam. It is then stored in tempering bins, which equalize the heat. From there it passes through an automatic registering scale, and to the first set of rolls.

Millstones were formerly used, and still are for some grades of flour. These burr stones, as they are called, are about four or five feet in diameter, and consist of a bed stone and a top stone or "runner." The upper stone revolves on a spindle, and the stock is fed in between the two stones and is *crushed*—which is the trouble. The entire wheat kernel does not want to be crushed, but the interior contents must be shelled out, crushing the hulls as little as possible. This can only be done by a gradual reduction of the wheat between corrugated steel rolls. The roller mill consists of a frame carrying two pairs of steel rolls, one roll of each pair being revolved in a direction opposite to the other. The rolls run at different speeds by means of differential belts. The prepared grain is fed between the rolls, striking the slow rolls first, and is then cut by the fast roll, so as to shell out the contents. The broken kernel is then elevated to a sieve machine called a "scalper," which consists of a flatwise sieve, which allows the granular material, which is called "middlings," to pass through the meshes, while the coarser part of the kernel passes over the sieve to the second set of rolls. This process is repeated five times (the grinding and sifting operations). The next process is the dividing of the middlings into various grades according to the size of the granules. The middlings from these five siftings are delivered to a grader, which may be either a reel or a sifter machine. These grading reels are covered with silk bolting cloth of various degrees of fineness, the finest section being near the head of the reel, and graduated toward the tail of the reel. It is a mistake to suppose that these grades differ in value; they relate entirely to size. Each grade of middlings is now put through a machine termed a middlings purifier. The introduction of this machine has revolutionized the practice of milling. The stock is fed in at one end of the sieve, and is advanced by the end motion of the sieve, which is covered with silk bolting cloth. A current of air is drawn up through the sieve by a fan located in the upper part of the machine; this carries off any fine dust into the dust collector, where it settles. The dust collector consists of some form of cloth tubes. The air forces the dust to the walls of the tubes and passes through the mesh, leaving the dust on the inside. The particles of bran that are with the middlings whose specific gravity is less than the interior of the kernel are kept from going through the meshes by the upward current. The bran is held in suspension until the end of the sieve is reached, when the air current is cut off, allowing it to fall into a separate conveyor. The purified stock which passed through the sieve is delivered by means of conveyors to a second purifier, whose action is the same; brushes moving at right angles to the motion of the sieve serve to keep the meshes of the cloth open. Each grade of middlings goes through the same process of purification. After the middlings are thoroughly purified, they go to the smooth rolls, where they are partially crushed, but not powdered. The life of the flour is killed if it is pulverized. From there it goes to the bolter, which is made in many forms, but for purposes of illustration we will consider a round reel or "flour dresser," as it is called. The reel is covered with fine silk bolting cloth, which may cost as much as $4 a yard. What flour is fine enough to go through the meshes of this reel is sent to the flour bins, and is ready for packing. What is too coarse to go through goes to the rolls and is recrushed and rebolted, and this process is repeated until all the middlings are crushed fine enough to go through the meshes of the cloth. The bolting cloth is kept free from clogging by a revolving brush, and the stock is thrown against the inner side of the cloth by beaters revolving around a horizontal shaft. Each grade of middlings goes through the same process, and then all the flour from the first two or three crushings is combined to make the first grade of flour.

The flour from the various grades of middlings is blended so as to produce, in the judgment of the miller, a flour of standard quality. The various streams of flour are constantly under inspection, and wet and dry tests are made every few minutes. The sample of flour to be tested is smoothed on a board with a sample which is standard; a portion is wet and baked in an electric oven, thus giving a most valuable color test. The grade of flour is always kept at or above the standard, but is never lowered. It is a mistake to suppose that lower grades of flour are made from inferior wheat; it is only the poorer stream of materials developed in the milling process, which contain too much of the branny material to go into the high grades, which are used for low-grade flour.

The flour is now ready for packing in barrels of 196 pounds and bags which range from 3 to 280 pounds. The barrels are placed on a machine located beneath the bin, and adapted to supply a large volume of flour, which will approximately fill the barrel; the supply is automatically cut off when the proper weight is reached. The weight of the barrel is then checked on another pair of scales, and any difference in weight adjusted with a scoop. A number of augers on an upright shaft within a broad iron tube serve to force the flour downward into the package, and prevent clogging in the tube. The barrels are now headed up and branded, and are rolled on board the cars which line alongside the packing room. An average box car will hold from 200 to 275 barrels. Last year the Washburn-Crosby Company shipped from their Minneapolis mills alone over 6,000,000 barrels of flour. A considerable proportion of the

Packing Flour in Barrels.



Sacking Flour and Sewing up the Tops.

A Dissected Wheat Kernel Magnified.

Raising and Baking Miniature Loaves of Bread for the Miller.

A Plan Sifter at Work.

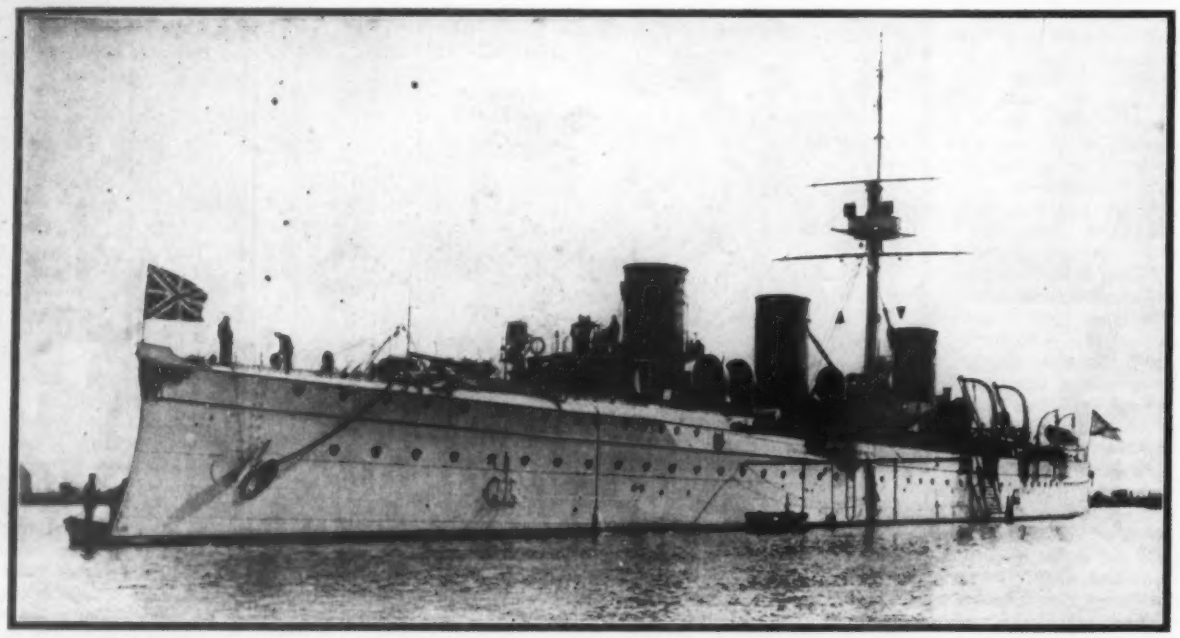
MODERN FLOUR MILLING.

flour milled is shipped in bags for family use or for export. Cloth bags are preferred, and are filled by machines working on the same principle as the barrel filler; they are sewed by sewing machines, are then run down inclines, and are carried on trucks to the cars. Bags are largely used for export purposes by the Washburn-Crosby Company, as barrels do not pack well, and the American flour sack can now be found in all parts of the world. American foodstuffs, on account of their purity and uniformity, have taken a prominent place in the markets of the world, and Minneapolis is now in the lead as a base of supplies.

THE DISABLED RUSSIAN CRUISER "NOVIK."

Among the vessels that fell a victim to the attack of the Japanese guns and torpedoes at Port Arthur was a vessel (the only one of its type in existence) which has attracted a great deal of attention in the naval world. We refer to the fast cruiser "Novik," of which we present an illustration. It was shortly after the close of the Spanish-American war that the Russian Admiralty sanctioned the announcement that they were about to build a fleet of several extremely fast protected cruisers, which were to have a speed far in excess of the fleetest vessels afloat at that time. Originally these boats were to have been of a little less than 3,000 tons displacement and 25 knots speed. The contract for the first of them, the "Novik," was given to Schichau, the well-known torpedo-boat builder of Elbing, Germany. She was launched in 1900, and delivered to the government in 1902. Her destination, like that of all the latest and best warships of Russia, was the Pacific station.

The "Novik," as constructed, is somewhat larger and faster than the vessels contemplated in the first designs. She is 347 feet in length, 39 feet 4 inches in beam, and on a draft of 19 feet displaces 3,000 tons. For a vessel of her size the engine and boiler room equipment is extremely powerful, consisting of twelve Thornycroft boilers, and triple engines with a combined indicated horse power of 18,000 to 20,000. On trial she developed a speed of 26 knots an hour, and therefore she is by about 2 knots the fastest cruiser in the world. So much being given up to motive power, the protection is confined to a 2-inch deck with a glacis of inclined armor above the engine hatches 3 inches in thickness. There is also a protection of 1¼ inches on the conning tower. All of this armor is treated by the Krupp process. In addition to her scouting duties, for which by virtue of her high speed she was admirably suited, the "Novik" was designed for the important work of chasing and sinking torpedo boats and torpedo-boat destroyers. For this work she was armed with six 4.7-inch rapid-fire guns, one 9-pounder, eight 6-pounders, and two 1-pounder rapid-fire guns. She also carried one above-water torpedo tube in the stern, and two above-water on each broadside.



Displacement, 3,000 tons. **Speed,** 26 knots. **Coal,** 500 tons. **Armor:** Deck, 2 inches. **Guns:** Six 4.7 inch; eleven smaller rapid-fire guns. Five torpedo tubes above water.

RUSSIAN CRUISER "NOVIK," THE FASTEST CRUISER EVER BUILT. DISABLED AT PORT ARTHUR.

In the meager accounts of the Port Arthur engagement, the "Novik" was mentioned as having been very active, maneuvering on the outskirts of the Russian fleet. It is probable that she was doing her best to sink the Japanese destroyers with her 4.7-inch guns, a single well-placed shell from one of which would have meant the complete disablement of any boat that was struck. Whether the "Novik" was disabled by torpedo or by gun fire is not very clear; but it is probable that it was the gun that put her out of action.

In addition to the "Novik," four other fast cruisers of the same type have been completed or are now under construction, while two others are proposed. Of the four, one, the "Almaz," is identical with the "Novik," having the same high speed; the "Boyarin," launched in 1900 at Copenhagen, was sent to the Pacific station, and two others, the "Jemtchug" and "Izumrud," launched in 1903, are now approaching completion. The last three cruisers, while of the same general dimensions as the "Novik" and carrying the same armor and battery, are not so fast by two or three knots, the contract speed being 22.5 knots for 11,500 indicated horse power. The "Boyarin," it would seem, must be added to the list of those Russian ships at Port Arthur that have fallen a victim to the deadly torpedo. It will be remembered that the first intimation of her loss came in the form of a dispatch from Port Arthur stating that the torpedo transport "Yenisei" and the cruiser "Boyarin" had been sunk by coming accidentally in contact with one of the submarine mines in the harbor. A day later came the announcement that the Japanese torpedo-boat destroyers had made another dash at the Port Arthur fleet in a driving snowstorm, that they had discharged their torpedoes, and thought that they had hit a couple of ships. Then followed a statement from Tokio, Japan, that these torpedo boats had succeeded in sinking the "Boyarin" and another vessel. The probabilities are that the last report is correct, and if so, the torpedo boat has added still further to the immense prestige it had already acquired in the present war.

Death of Prof. Charles E. Beecher.

On February 14, Prof. Charles Emerson Beecher, who occupied the chair of palæontology at Yale, died suddenly at his residence in New Haven. Prof. Beecher was forty-eight years old. A graduate of the University of Michigan of the class of 1878, he pursued a post-graduate course at Yale which earned for him the degree of Ph.D. Shortly after his first appointment to a position on the University staff, he was made professor of historical geology. He succeeded Prof. Marsh as curator of the geological collections and professor of palæontology.

His most important contributions have been to the knowledge of the development and structure of the trilobites and brachiopods. Several papers on the ontogeny and phylogeny of these and other classes of animals were collected in one volume entitled "Studies in Evolution," which appeared in 1901 as one of the Yale bicentennial publications. He also published "Brachiospongidae: A Memoir on a Group of Silurian Sponges," Memoirs of the Peabody Museum of Yale University, Vol. II., Part I., in 1889. In 1899 he became a member of the National Academy of Sciences.

The Current Supplement.

The current Supplement, No. 1469, opens with a most instructive article by Charles H. Stevenson on the dressing and dyeing of aquatic furs. The article is well illustrated by engravings, which clearly show the processes involved. "Natural Products and Scientific Industry" is the title of an article written by Dr. Otto N. Witt, the well-known German chemist. From the mechanical standpoint, by far the most important article in the paper is a thorough discussion of the evolution of watch escapements. The article is very elaborately illustrated. The sleeping sickness, of which we hear so much in these days, is analyzed in a competent way. The walls of ancient Troy are illustrated and briefly described. William Ackroyd writes on "A Principal Cause of the Saltness of the Dead Sea." The usual electrical notes, engineering notes, and consular information will be found in their accustomed places.

The Commerce of the Far East.

The value of the commerce of the countries fronting upon the scene of hostilities in the Orient aggregates about 600 million dollars per annum, and the value of the commerce of the United States with those countries aggregates over 100 million dollars per annum. While the prospect of war resulted in the placing in the United States of orders from Japan for flour and from Russia for meats, the general trend of exportation to the four countries fronting upon the scene of hostilities has been downward during the period in which this subject has been actively discussed. To Japan the exports from the United States during the month of December, 1903, were $2,263,245 in value, against $2,811,589 in December of the preceding year, and for the entire calendar year 1903 were about one million dollars less than in the preceding year. To Asiatic Russia the exports from the United States were $716,274 in 1903, against $898,711 in 1902 and $1,013,320 in 1901. To China our exports during 1903 were materially below those of the preceding year, being for the month of December $841,373, against $1,857,733 in December, 1902, and for the entire year $14,970,138, against $22,698,282 in 1902. This reduction occurs chiefly in cotton cloths, of which our total exportation to China in December, 1903, was but 3,665,364 yards, against 20,582,544 yards in December of the preceding year, the value being $230,546 in December, 1903, against $1,074,463 in December, 1902. For the entire year the value of the cotton cloth exported from the United States to China was $8,801,964, against $16,048,455 in the calendar year 1902. This reduction in exports to China is not peculiar to the United States, as the official reports of the Chinese government show a general reduction in its imports during the past year, up to the latest period covered by the reports.

To Russian China our exports show an increase, being in 1903 $846,310, against $421,163 in 1902. To Korea the exports of the year also show a slight increase, being valued at $370,566 in 1903, against $257,130 in 1902. To Hongkong, which is sufficiently far removed from the scene of existing disturbances to be less affected, apparently, by such conditions, the exports from the United States show an increase, being in December, 1903, $1,705,436, against $1,417,736 in December of the preceding year, and for the entire year $9,792,193, against $8,751,779 in 1902.

As to the trade of the United States with Manchuria, it is not separately shown in the general statements of the commerce with China. The Department of Commerce and Labor, through its Bureau of Statistics, however, has recently compiled some figures which show that the imports of Newchwang, the principal port through which Manchurian commerce now passes, amounted in 1902 to about 18 million haikwan taels, against 17 millions in 1901 and 8 millions in 1900. The value of the haikwan tael in 1902 was 63 cents, so that the value of the imports of Manchuria, stated in dollars, would be, in 1902, about $11,000,000. The official report of the Chinese government does not specify all classes of merchandise received into Newchwang from the United States, but does specify the four principal articles—American jeans, drills, sheetings, and kerosenes. The total value of these four articles of American production reported as brought into Newchwang in 1902, either coming direct from the United States or from other ports of China, was 6,118,920 haikwan taels, which at the official valuation of the haikwan tael in 1902 would make the total value in United States currency $3,854,920.

A Medal for Prof. Hale.

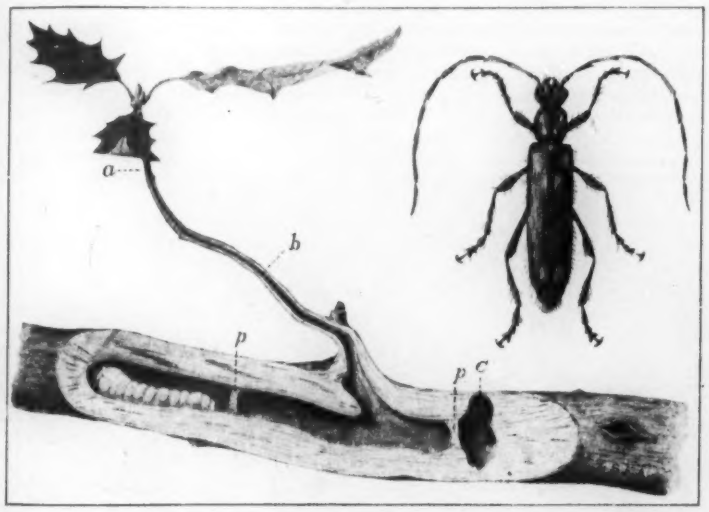
Prof. George E. Hale, director of the Yerkes Observatory, has been awarded a gold medal by the Royal Astronomical Society.

THE PARASITE OF THE OAK PRUNER.

BY S. FRANK AARON.

Woodsmen often observe, beneath red, black, and scarlet oak trees, many branches fallen upon the ground that look healthy enough to have remained upon the parent trees. At first self-pruning, common with many trees, was surmised, but often these branches are very many, and the trees seem to have lost too much thereby. Closer inspection disclosed the butt ends of these branches to have been cut away from within, only the bark and thin outer wood left to have been broken, and a plugged hole, leading into the center of the branch, foretold a clew. When the branch was split open, a little white grub larva was discovered at work in a lengthwise-to-the-branch burrow, or fast asleep perhaps during the months of cold.

Naturalists took charge of the case. Careful observation during many years made known the complete life history of this interesting insect and showed the cause and extent of its destructive work. Early in the spring the female of a beetle known as *Elaphidion villosum*, a long-horned, gray-brown member of the Cerambicidæ, lays its eggs in the green and tender leaf twig of the oak, and the tiny larva, hatching soon thereafter, eats its way down the pithy center of the twig, enlarging its burrow as it grows, until it reaches the branch, which of course may vary in size from that of a lead pencil to even the thickness of one's wrist. And here follows an illustration of the development of a remarkable instinct, and its result. Just below where the burrow enters the branch, the larva extends its boring at right angles across the branch, cutting away the heart until the thin outer sapwood is reached, sometimes, *on the lower side*, leaving a little of the heart wood, and no doubt being governed by the final stretching of the fibers as the branch sags. Then it withdraws again into the burrow, plugs with its cuttings and saliva, called "powder post," the hole next the wide cut, so that, when the branch breaks, insect enemies or tongue of woodpecker may not intrude, and then during warmer weather it cuts its way outwardly along the branch, finding in the wood of its snug retreat both food and shelter. Meanwhile the cut and weakened branch cannot withstand the high winds and heavy sleets of winter and breaks off and falls, to be covered with leaves and snow and thus escape the prying search and chisel bills of the tree-loving woodpecker, only the flicker occasionally searching upon the ground.



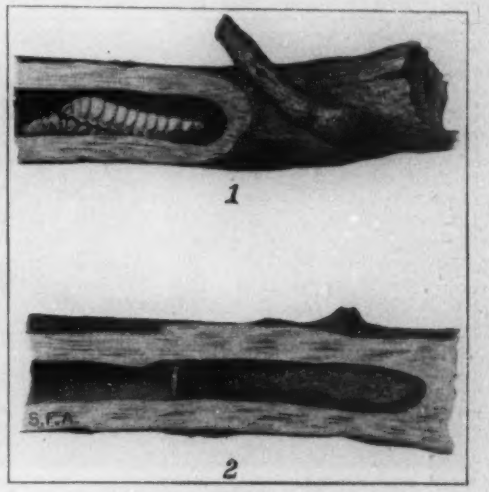
THE OAK PRUNER BEETLE AND ITS LARVA AT WORK IN ITS BURROW.

a. Place where egg is laid and young larva begins to burrow. *b*. Continuation of burrow from twig to branch. *c*. Pruning-cut in branch. *p p*. Powder post plugs protecting the larva.

From the date of its hatching to the time of its transformation into the pupa, the larva lives nearly two years. The first summer is spent in reaching and cutting the branch, and the second winter is spent generally in the inactive pupa form. The following spring the beetle emerges, cutting its way to the outside world through the powder post plugs.

Often these insects are quite destructive, and where there are groves and bunches of the soft-wood oaks, the pin-leaf group that ripen their acorns in two years, the insect exists in countless numbers, endangering and stunting the life of the trees and often killing large limbs by its pruning. It frequently infests, also, the chestnut, but I have rarely found its work on white oaks or their hardwood cousins. It is evident that the insect-eating birds do little to check this species. But yet the pruner has not undisputed sway, and of this it remains for us to add another chapter.

It is to the family Ichneumonidæ of the order Hymenoptera that we turn, in this case as in so many others, to find the real enemy of the oak tree pruner. A small fly, hardly over a quarter of an inch (8 or 9 millimeters) long, with shining black head and thorax, bright red abdomen and smoky wings, probably belonging to the genus Melanobracon, is the self-appointed agent for this good work. During the summer the larva of Elaphidion is hard at work in its burrow, and the sound of its cutting may be plainly heard within a foot or two. It is at this time that the little ichneumon fly, moving actively about on wings and legs and probably gufded by the sound of this cutting, locates the position of the beetle larva. The excitement of the fly is greatly increased as it finds itself upon the severed branch. Constantly moving its antennæ, walking as if on springs, it discovers the desired spot, and then, unsheathing its keen and slender ovipositor, it rapidly proceeds to force it through the bark and into the tough wood, standing on rigid legs meanwhile and using the upper portion of the divided sheath to guide, brace, and strengthen the ovipositor. The wood wall of the burrow, perhaps an eighth of an inch or more in thickness, is in time pierced, and the fly goes through added contortions while forcing the egg through the now somewhat constricted organ. Presently, with some difficulty and hard pulling, the ovipositor is withdrawn and the fly takes wing to seek more victims. I think, in the single instance observed, the whole operation, from the insertion to the withdrawal of the ovipositor, must have taken over an hour and a half. I marked the exact spot of the puncture, took the branch home, and split it open carefully. The small larva was there and not an inch away from where the egg had been inserted into the burrow, but the larva may have squirmed forward meanwhile or the ichneumon might have hit it exactly. Who can tell? But try as I could, with a powerful lens, I failed to find the egg of the ichneumon. Carefully replacing the split-off piece, however, I put the branch in a safe place and examined it from time to time. In about five days a little white maggot, the hatched and rapidly growing larva of the ichneumon, had attached itself to the sixth segment of the beetle larva and was sucking the blood of its victim most voraciously. Eight or nine days later this maggot larva, elongated oval and nearly pointed at both ends and of a sickly white color, was about full grown; the beetle larva had perished miserably, and two days later was entirely devoured; I could not find even the hard, wood-masticating mandibles. And then this very unintelligent-looking fly larva proceeded to belie its looks; it did just what the accomplished beetle larva would have done, only did it better. It plugged up one end of the burrow, using silk instead of powder post. Inclosing itself in a snug cell safe from intrusion and adding a filmy transparent silk cocoon that tightly fitted or really lined its retreat, it became, in a few hours, an altogether inactive pupa. In about a week the perfect fly emerged and has since, with a piece of the branch and the burrow and its cocoon exposed to view, graced my collection. And so Elaphidion, the pruner, with all its instinctive caution, hedged about with remarkable security, frequently gets its quietus by the intelligent procedure of this insignificant-looking little fly, and instead of further robbing the noble oaks, dies an awful death in its immaturity.



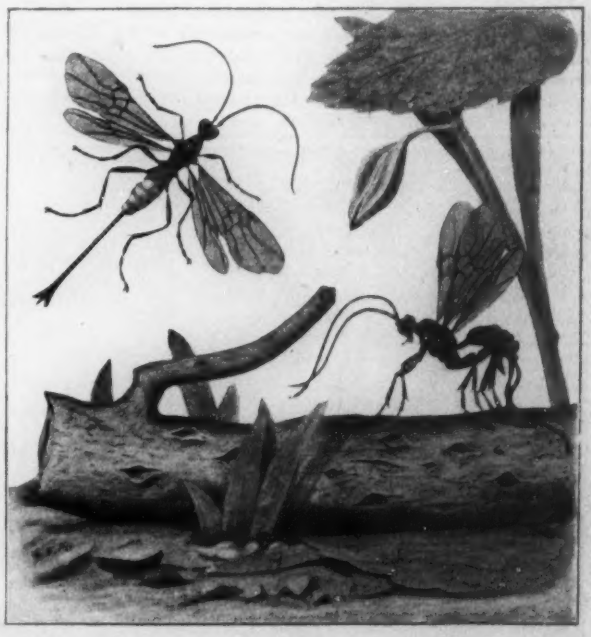
PARASITE OF OAK PRUNER.

1. Larva of ichneumon fly feeding on beetle larva. Branch shows broken pruning-cut of beetle larva. 2. Silken plug and cocoon of parasite in end of burrow of beetle larva.

The New English Lead Glaze Rule.

Lord James of Hereford has signed his final award as umpire in the arbitration on the use of lead glaze in the making of pottery in England. The question was raised by the issue from the English Home Office of special rules for the manufacture and decoration of earthenware and china, and Lord James made a first award upon these on December 30, 1901. The final award, dated November 28 last, establishes a new rule 2, under which it is generally provided that after February 1, 1904, no glaze shall be used which yields to a dilute solution of hydrochloric acid more than 5 per cent of its dry weight of a soluble lead compound calculated as lead monoxide, when determined in a manner prescribed by the rule. The use of a glaze which does not conform to the above-mentioned conditions is, however, to be permitted after due notice to the inspector for the district, subject to the adoption by the manufacturer of a new schedule of compensation to employes, who may be suspended on being certified as suffering from plumbism (or lead poisoning) and subject also to periodical examination of the employes by the certifying surgeon. China scouring is excluded from the processes dealt with by these regulations. The prescribed method of testing the glaze is as follows: A weighed quantity of dried material is to be continuously shaken for one hour at the common temperature with one thousand times its weight of an aqueous solution of hydrochloric acid containing 0.25 per cent of HCl. This solution is thereafter to be allowed to stand one hour and to be passed through a filter. The lead contained in an aliquot portion of the clear filtrate is then to be precipitated as lead sulphide, and weighed as lead sulphates.

River and harbor pilots will be put out of business entirely if the invention of Prof. R. B. Owens should come into general use. Prof. Owens is now professor of electrical engineering at McGill University at Montreal, and the device referred to above is an electrical apparatus by which a boat may be taken through a narrow channel, without the least danger of grounding, by an officer of the boat entirely unacquainted with the water through which he may be passing. A properly insulated and protected cable is laid in the channel to be followed by the craft. An alternating current is passed through the cable, and two telephones on board the vessel are acted upon by the magnetic influences of the cable, so that it is possible to detect the deflections of the boat with regard to the position of the cable by listening at the receivers of the instruments.

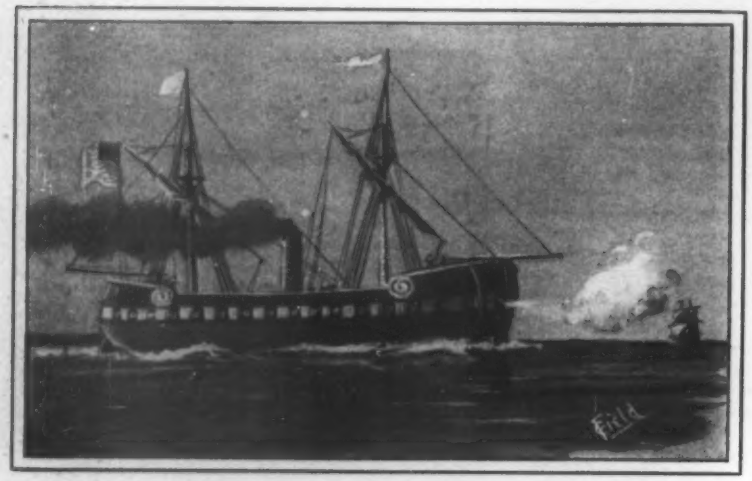


ICHNEUMON FLY PARASITE OF OAK PRUNER BEETLE. DORSAL VIEW SHOWS IT LAYING AN EGG WITHIN A BRANCH OF AN OAK. BRANCH SHOWS PRUNING-CUT OF BEETLE LARVA.

EARLY ARMORCLADS.

BY MAJOR C. FIELD, GLENMORE, ENGLAND.

Although armorclad ships are generally considered to date only from the middle of the last century, armor, in the general and extended use of the word, has been used for the protection of ships for hundreds, nay thousands, of years. Not, of course, nickel-steel or even iron armor, but a protective covering of various materials; for as the warriors of the past wore steel, iron, brass, leather, and even quilted cotton armor, so have ships been protected by a variety of different substances. The modern word "cuirass," which we apply solely to body armor as worn by the Life Guards, and which is of French derivation, is used also in France for the armor of a battleship and reminds one at once that armor was originally made of leather or "cuir."



FULTON'S "DEMOLOGOS," OF 1815. THE FIRST STEAM WAR VESSEL.

As with men so with ships. The ships of the ancient Greeks and Romans were often fortified with a thick fence of hides, which served to repel the missiles of their enemies and afford protection to their own crews. Hides, possibly brass and iron, and certainly thick timber, entered into the construction of the turrets and towers with which the fighting ships of ancient and medieval times were fitted, especially when used for harbor defense, as in the Venetian turret ship of the ninth century here illustrated. Felt made an early appearance as a defensive armor on shipboard, as we find that in a sea fight off Palermo in 1071 between the Normans and Saracens, the former hung their galleys with this material by way of a defensive cuirass. The Norman knights had probably adopted this device from their enemies, for felt had been used for some time for this purpose on board the huge "dromons" of the Saracens. These, the "battleships" of those days in the Mediterranean, usually rowed fifty oars a side, each oar being manned by two men, so that here we have a couple of hundred seamen accounted for at once. When the soldiers, sail trimmers, and artificers who worked the war engines and siphons for Greek fire are added, it is evident that the crew must have been very large, and have required a ship of considerable dimensions. These great warships were armored with woolen cloth soaked in vinegar to render it fireproof, and hung with mantlets of red and yellow felt, so that their cuirass was not only useful, but ornamental as well. At this period, and for many hundreds of years later, additional protection was afforded to those on deck by the ranging of the bucklers and shields of the warriors on board along the gunwales. Later, in the fifteenth and sixteenth centuries, special "pavesades" or bulwarks were provided in lieu, composed of large oblong shields supplied for the purpose. In addition to felt, the time-honored leather armor also entered into the defensive panoply of the "dromons," and in the war of the Sicilian Vespers, Pedro III. of Aragon, who commenced his reign in 1276, covered two of the largest ships of his fleet with leather before sending it against Charles of Anjou.

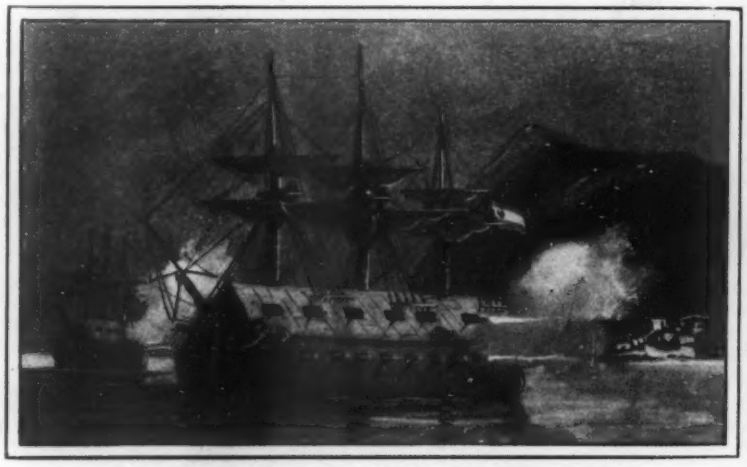
These, by the way, were not the first "leather-clads." We have already seen that leather, probably in the form of rawhides, formed a portion of the armor of the Saracen dromons, while Conrad of Montferrat, at the siege of Tyre in 1187, either invented or at all events caused a special class of leather-protected vessels to be built, which were called "barbotes" or "duckbacks." They would now probably be called "turtlebacks." They would appear to have been small craft covered with a strong leather-protected domed roof, through portholes or openings in which the archers and crossbowmen could fire without exposing themselves. They proved very effective against the Saracens, and in 1218 the entrance of the Nile was forced by seventy of these little armorclads.

But in the meantime the Saracens seem to have "gone one better" in the evolution of armor protection, for it is said that the "Great Dromon"—whose capture by Richard Lion-Heart is still commemorated by the stars and crescent in the arms of our greatest naval port—was equipped with leaden armor. This was in 1191, and probably lead was occasionally used for protective purposes throughout the next two or three centuries, although there is no record of any ship so protected until 1530.

In this year the Knights of St. John, those sworn opponents of the Turk, built one or perhaps two "lead-clads." At any rate, one account says that they built such a ship in this year at Malta, while another describes a ship of this kind called the "Santa Anna," launched at Nice in the same year. The "Santa Anna's" leaden armor plates were attached to her sides by bolts of brass, and it was claimed for her that she could "resist the artillery of a whole army," and at the same time could sail or row as fast as any of her unarmored contemporaries. She was a big ship, with six decks, a reception saloon, a chapel, a specially constructed powder magazine, and a bakery. She was present at the taking of Tunis in 1535, and played an important part in its capture.

Lead, it may be remarked in passing, was not infrequently used at this period for sheathing ships under water, in the same way that copper is still found so useful. Thus the French ship "Grande-Françoise," launched in 1527, one of the largest and most famous ships of her day, was sheathed with lead from her keel to the first wale above her waterline.

According to a short paragraph in Hayden's Dictionary of Dates, "Chain netting of iron was suspended to the sides of men-of-war, which were also strengthened by plates in the time of Henry VIII. and Elizabeth." No authority is quoted, nor is the material of the "plates" specified. The assertion seems a little difficult to believe, because Sir William Monson in his famous Naval Tracts, in one of which he specially deals with protective devices, does not mention either of these systems; and as he served at sea in the reign of Elizabeth, he could hardly fail to be acquainted with them if in general use. What he suggests is "a device made with a plank of elm, because it does not shiver like oak. This plank is musket-proof, and removed with trucks from one part of the ship to the other, which is a good safeguard for small shot. In my opinion I prefer the coiling of cables on deck, and keeping most of the men within them." Again, in his proposals for a class of ship to be superior to all others afloat, he says: "All parts of the ship shall be made musket-proof for the safety of the men. Low by the water and without-board they shall be fortified with packs of wool, that no shot shall pierce them." Here we have a prototype of our modern waterline belt at once. The Spaniards attempted to protect their galleons of the Invincible Armada by building their sides four or five feet thick, but the heavy English guns "lashed them through and through." But now at last we arrive at a real armored ship in the present-day acceptation of the word. Not only an armorclad, but a real ironclad. This was constructed in Antwerp in 1585, with a view of breaking through the lines of the Spanish army under Alexander of Parma, which was at that time closely investing the city. It was a large flat-bottomed craft, with a central casemate or battery built of thick balks of timber and plated with iron. It was intended to be, and very likely was impenetrable to any artillery that the Spaniards could bring against it; and in hopeful anticipation that their ironclad ship would raise the siege and put an end to hostilities, the men of Antwerp christened her the "Finis Belli." In addition to a heavy battery of guns, the "Finis Belli" carried a large body of musketeers, some of whom were stationed aloft in her four fighting tops, while the rest were well protected by the loopholed bulwarks on the upper deck. Unluckily for the besieged Dutchmen, she ran aground before she had effected anything at all, and fell into the hands of the Spaniards, who nicknamed her the "Caranjamula," or as we should say "Bogey." They contrived to get her afloat, and brought her down to the camp of Alexander of Parma, where she became a great attraction to the sightseers of the period. As for the Dutchmen in the doomed city, they henceforward only referred to their fruitless experiment as the "Perditæ Expensæ," or "Wasted Money." Ten years previous to this, others of the Dutch patriots had built a somewhat similar contrivance, which very possibly was also armored. This was the "Ark of Delft," a twin vessel supporting a floating fortress, which was propelled by three hand-worked paddle-wheels placed between the two hulls.



THE SPANISH FLOATING BATTERIES BEFORE GIBRALTAR.

THE FIRST IRONCLAD, THE "FINIS BELLI," AGROUND AND ABANDONED BY THE DUTCH.

It is a curious but well-known fact that if we go to the far East, we can find a parallel to almost any western invention. It is therefore not astonishing to find that the Japanese possessed a paddle-propelled armorclad in the year 1600. This quaint craft, like the old leatherclad "barbotes" of the twelfth century, was turtle-backed, with ports for firing from. She was covered with iron and copper plates fitted together like the cells of a honeycomb, mounted ten guns, and like the "Ark of Delft," was moved by a central paddle-wheel. Though there is no record of any more iron-

clad ships before the nineteenth century, our own navy at any rate used various devices to protect its ships in the eighteenth. According to a French writer, the sailors of his country were astonished at the perfection to which the English had attained in this direction. "Old cables," he writes, "held in place by pieces of iron barricaded the whole length of the bulwarks; mantlets of old rope hung over the ship's sides to diminish the shock of our cannon balls, and, beneath a thick rope netting stretched from poop to bowsprit, the English fought under shelter, maneuvering without ceasing out of musket range, so as to riddle our detachments of fusileers with their cannon shot. So we lost two hundred men for every thirty of the English put out of action."

This system of armoring was, however, soon adopted by the French, as in Lescallier's "Vocabulaire des Termes de Marine Anglois et François," published in 1777, we find the following:

"'Blinder un vaisseau,' to cover the ship's side with fenders of old cables to preserve her from an enemy's shot, when employed to defend a harbor, etc."

The Spaniards endeavored to improve on this, and in 1782 hoped great things from the celebrated floating batteries employed at the great siege of Gibraltar by the Duke de Crillon.

"The floating batteries used at Gibraltar," says a contemporary account, "were mounted on ships of the line cut down to a particular size. On the top they were defended by a covering made of cordage and wet hides." This was not the complete protection that was originally intended by the Chevalier d'Arcon, their constructor, according to another account of the same date as the above, which states that "The covering was to have been laid over with strong sheets of copper, and by this means the red-hot balls, the bombs, and other destructive implements, would have slid off." A "Journal from on Board the 'Victory,'" from 8th to 21st October, 1782, gives further particulars of the protection of the Spanish batteries as follows: "Ten ships of war of different rates were appropriated, rendered bomb-proof, and fitted with wonderful precaution, having a sloped roof and the sides seven feet thick with cork, wet sand, etc., and having channels which by means of pumps were kept continually full of water. How all this was in vain is a matter of history; but the following succinct account of the end of the floating batteries, published in the Gazette de France of September 27, 1782, is worth quoting:

"14th (Sept.) In the morning we lost everything excepting our honor. The floating batteries, which were believed to be proof against the balls and bombs, were found to be entirely insufficient. In a moment the whole were set on fire. The fire raged prodigiously, particularly in that one in which was the Prince of Nassau. By a miracle it happened that he was neither killed, wounded, burnt, nor drowned. Never did the bravery of two nations ever shine with so much advantage as in this unfortunate attack. About noon all the floating batteries were blown up or sunk; the loss of the besiegers was about 1,200 or 1,500 men. The red-hot balls and bombs did execution in all parts."

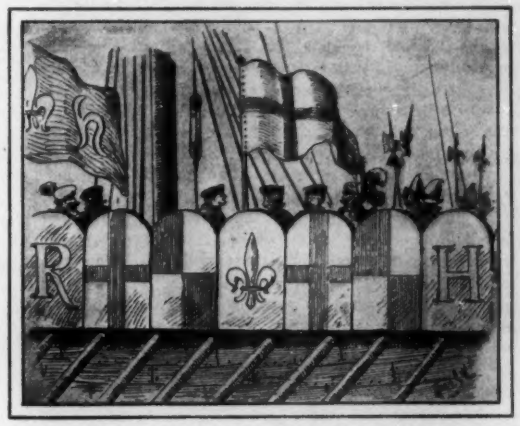
The fate of these experimental armorclads offered no inducement to the naval constructors of the day to make further researches in the direction of protection, so that till comparatively recent times we find our sailors depending only on their "wooden walls" to resist the projectiles of the enemy. The oaken sides of the British ships, we may note in passing, were often exceptionally stout and difficult to penetrate.

In the fight between the "Glatton," 56-gun ship, and four French frigates, a brig, and a cutter, mounting 220 guns between them, their 12 and 24 pounders failed to penetrate her sides, and she beat them all off with great loss at the cost of one officer and one man wounded.

But the Americans, from the very commencement of their existence as a nation, set themselves to make improvements in naval warfare. David Bushnell constructed a practical submarine boat in 1773. Torpedoes were used by him and others in the war with this country, and for the purpose of towing these contrivances alongside our ships, they invented and built in 1814 a paddle-propelled turtle-backed boat lying very low in the water and covered with "half-inch iron plates, not to be injured by shot."

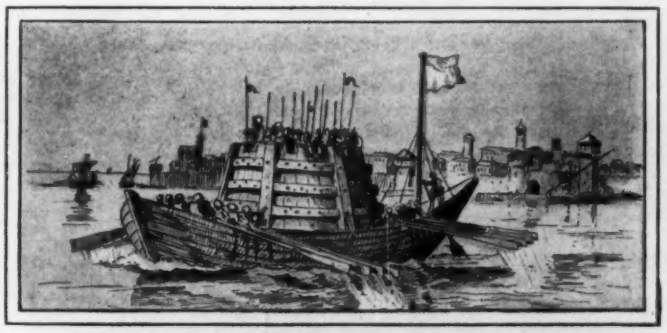
About the same period the celebrated inventor Robert Fulton, who had already constructed one or two submarine boats and various classes of torpedoes, built a steam frigate which he called the "Demologos," or "Voice of the People," but which is sometimes known as the "Fulton I." This, the first steam warship ever constructed, had her sides no less than 13 feet thick of alternate layers of oak and ash wood, a thickness absolutely impenetrable by any gun then afloat. In 1829 this vessel was blown up by accident, and was succeeded in the American navy by the "Fulton II.," a ship which appears to have been protected by some kind of iron armor.

Various proposals were made to use iron plating to protect the sides of ships of war from this time forward, but until the French constructed a number of

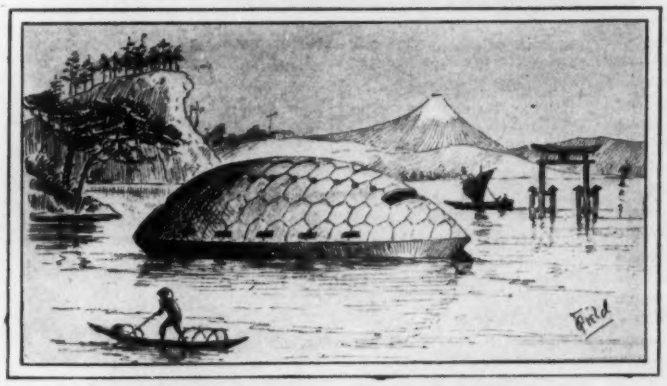


AN ENGLISH GALLEY OF THE TIME OF HENRY VIII.

armor-plated batteries for use in the Crimean war, nothing practical came of the suggestions of inventors. Their success at the bombardment of Kinburn demonstrated the value of armor plating. England at once followed suit with others of the same kind, some of which are still doing duty as hulks. Then came the French "La Gloire," the British "Warrior," the ironclads and monitors of the American war, and thenceforward the steady evolution of the armored fighting ship, which has provided us with the majestic battleships of the present day.



TURRET SHIP USED IN THE DEFENSE OF VENICE. NINTH CENTURY.



A SEVENTEENTH CENTURY JAPANESE ARMORCLAD.

Thomas A. Edison's fifty-eighth birthday and the twenty-fifth anniversary of the invention of the incandescent electric lamp were celebrated at a banquet given to the inventor at the Waldorf-Astoria Hotel, New York. Although it is too soon to estimate at its true worth the debt which modern civilization owes to the inventions of Mr. Edison, still we are able to judge something of their usefulness. Of all his inventions, perhaps, the incandescent electric lamp has been fraught with the greatest utility to mankind, and has found the widest application of any of his numerous contrivances. As we have pointed out more than once in these columns, the lamp is the result of unflagging pertinacity in experimental work on the part of Edison—a pertinacity which has always distinguished his methods as an inventor.

New Electric Inventions and Experiments.

Railway engine.—Experiments have recently been conducted on the 1-meter gage line connecting St. Georges de Commiers and La Mure, in the Department of Isère, with a 500-horsepower electric engine, using a continuous current at 2,400 volts. This engine, constructed by the Geneva works, weighs 50 tons, is 12½ meters (41 feet) long, and admits a speed of 22½ kilometers (14 miles) per hour, with a load of 110 tons, over the stretch of line rising on an average of 0.0275 meter per meter (1.08 inches per 39.37 inches) and with curves of 100 meters (328 feet) in radius. The electric power required is supplied by the hydro-electric plant operated by the Drac torrent. The line is worked on the three-wire overhead system, the current being delivered by means of a top-head trolley.

Suppression of synchronizing.—A method of reducing or entirely suppressing the synchronizing or equalizing currents which flow between single and multiphase alternators is described in a patent recently secured by a Bohemian inventor. In the arrangement employed for securing these ends, the alternators are connected to the primary windings of a pair of transformers placed between the alternators, and of which the secondary windings are connected together. The windings are arranged so that normally the magnetic effects of the currents in the primary and secondary windings balance each other. In the case of a larger number of alternators a corresponding number of transformers is used, all the secondary windings being connected together in series. For three-phase machines, three-phase three-core transformers are employed, and in each case the primary windings of the transformer and the armature windings of the generator have a common neutral point.

Regulating consumption of energy.—A Viennese invention provides a method of, and means for, automatically regulating the consumption of energy in a system of electric traction. The current is supplied by a compound-wound generator, of which one field winding is in connection with a separate exciter, while the other is in series with the mains leading to the motor. These two windings are arranged in such a manner that they act in opposition, so that the voltage of the generator is varied automatically in a contrary sense to the main current, which avoids the necessity for employing starting resistance in the main motor. The motor field may be separately excited by a battery with a reversing switch and rheostat for adjusting the strength of the field as required. In applying the invention to electric railways, independent generators are employed for supplying the separate leads of a number of line sections, on each of which not more than one train is running at the same time.—Oliver J. D. Hughes.

Improvements in Lord Kelvin's Compass and Sounding Machine.

Several improvements in the design and construction of Lord Kelvin's patent compass and sounding machine have just been introduced. In the newest form of the compass the illumination is effected from below, and either oil lamps or electric light may be used. The bottom of the compass bowl is in the form of a strong, thick lens, through which the light is refracted on the card. The intensity of the light may be varied at the pleasure of the observer, and this is found to be exceedingly useful in taking bearings of stars or other faint lights. A new antivibrational suspension has been designed, which insures great steadiness in the card; and a new form of helmet, with rifle sights, facilitates very considerably the work of taking bearings. With the new helmet navigators are able to take bearings of lights and stars by night with the same ease and convenience as bearings of the sun are now taken by day. The new form of sounding machine has been constructed of a height which has been found, from practical experience, to be the most suitable for the work of winding in the line. In addition to this great advantage, the new machine has an improved form of brake action, and a further advantage is that the working parts of the machine are all in sight and can be easily removed if necessary.

Reports from St. Michael, B. C., are to the effect that the well-preserved body of a mammoth has been found by Indians in a glacier near that point. Charles Runner, a hotel proprietor at Skagway, has organized an expedition to investigate the report. An effort will be made to exhibit the find at the World's Fair. The body is said to be 20 feet high and the tusks more than a foot thick. The only other complete specimen ever obtained is now in St. Petersburg.

Legal Notes.

The Bates Drill Patent Again in Court.—Suit was brought by the American Pneumatic Tool Company against the Philadelphia Pneumatic Tool Company (123 Fed."Rep. 891) for the alleged infringement of letters patent 364,081, granted to A. J. Bates. The defendants stated in their answer that the complainant had no title in the Bates patent. The uncontroverted evidence, however, showed that complainant was the owner. Of the nine claims of the patent, only one, the third, was involved, which reads as follows:

"In the pneumatic drilling tool described, and in combination with the case having an inlet and exhaust port, the cylinder, *D*, having a piston chamber and a valve chamber arranged separate from each other, and connected by means of ports and air passages, the piston, *B*, and valve, *J*, for controlling said piston through the medium of said ports and air passages, substantially as and for the purpose set forth."

The defendants answered by setting up the usual defenses of non-infringement and want of patentability and novelty in view of the prior art.

The Bates patent has been in suit several times before; and its scope has been variously construed in different suits by the Circuit Court of Appeals. In the case of the American Pneumatic Tool Company vs. Fisher (69 Fed. Rep. 467) the claim was considerably narrowed. In the Fisher case the tool under consideration was manufactured by the defendant under patent 472,495 to Drawbaugh. Afterward in the case of American Pneumatic Tool Company vs. Bigelow (100 Fed. Rep. 467) Judge Townsend, considering the validity of the Bates patent and its scope as settled by the Fisher case, granted a preliminary injunction which, however, was dissolved on appeal. The opinion of the court by Judge Shipman, limiting the scope of claim 3, which had previously been accorded a broad interpretation, influenced the court in deciding the controversy under discussion.

Defendants' portable pneumatic tool, alleged to be an infringement of the Bates patent, was manufactured under the Keller patent, 647,415. The Keller tool is extensively used for various kinds of heavy calking and riveting in metals; and its utility has not only been generally recognized, but as a hand tool it has in the last few years gone far toward displacing the hammer and other ordinary hand implements in shops where the arts of metal-working and of drilling in stone, and especially of chipping and riveting in metals, are made industries. Patents were cited by the defendant which were not considered in the previous adjudications, as well as other patents which the court previously had analyzed. From the evidence, and from a careful reading of the decision in the Circuit Court of Appeals limiting and defining the scope of the patent, and from the decision of Judge Townsend in the Bigelow case, the court came to the conclusion that claim 3 is entitled to a narrow interpretation only.

The general parts and functions of the Bates tool can be briefly described. The mechanical functions of the ports or passages or channel ways which are located between the cylinder and the outer inclosing case are to transmit motion and energy between movable portions or mechanical metal parts in the manner as hereinafter stated. The inner case or cylinder is bored lengthwise to provide a chamber or enough space for a movable piston or hammer. The cylinder is also bored crossways at its upper part to provide a chamber or sufficient space for a direct-acting balanced valve. The valve is spool-shaped. The spaces referred to—more properly called the valves and piston chambers—are divided or separated by a diaphragm. The movable parts in the cylinder are the valve above described and the piston or hammer, which are contained in the chamber specially arranged as above stated. The velocity of the valve and reciprocating piston or hammer is governed and controlled by means of compressed air projected against the upper side or rear end of the piston. The piston has through its length a round opening, wherein is firmly secured a movable striker. The striker has an annular flange wedged or fitting tight into the lower end of the piston, and is riveted down at its upper end. From the lower end the striker extends into a hub of suitable space to permit the movement of the striker, which is operated by the movement of the piston. The piston has two annular grooves, which provide space for an inlet and exhaust of the motive fluid. The cylinder, which slides telescopic fashion into the inclosing case or sleeve, has ports, grooves, or channel ways for inlet and exhaust motive fluid, and its surface is a medium in the control of the piston at each end.

An examination of the expert evidence on both sides, together with the drawings, specifications, and exhibits, satisfied the court that the principle of operation of the valve and piston in defendant's device practically attained the same result, but not by the employment of equivalent means, in view of the narrow scope of the claim upon which infringement depended. Defendant's valve and piston device may be described as follows: The valve is located in a separate box or valve chamber; not, as in complainant's device, integrally with the cylinder or piston chamber, but in a direct line with the piston. The center line of the piston is also the center line of the valve. The movement of the valve is vertical, and in a direct line with the movement of the piston. Thus it will be seen that the Keller valve chamber is contained in a separate piece of metal, and is removable from its place at the upper end of the piston chamber by unscrewing the cap which holds the valve box in place close to the piston chamber. The Keller piston is a solid piece of metal, having a groove which is alternately in connection with live-air pressure near the forward end of the stroke. Both the upward and downward movement of the piston are by means of the air passages and ports leading from the valve chamber to the piston chamber.

Although an expert decided that "the valves in both tools control the application of air to both sides of the piston or reciprocation hammer," it was understood, and correctly, to the court's mind, that the structural dissimilarities of the valve and piston produce a different mode of direct operation. Furthermore, the evidence tended to establish the impossibility of using the defendant's valve and piston in a separated valve and piston, which were described in the patent in suit, without completely changing complainant's tool. Although the operation of defendant's valve and piston practically resulted in the valves' controlling each end of the piston, such valvular control seemed to be a functional result caused by the valve and piston arrangement, which, as already stated, was not strictly equivalent to complainant's device. The bill was dismissed.

United States Flags as Trademarks in New York.—The Appellate Division of the Supreme Court of the State of New York has decided that Sec. 640 of the Penal Code, which prohibits the use of the representation of the United States flag for the purpose of trade advertisement, is unconstitutional.

The court holds that the section violates not only the State, but also the Federal Constitution, and is an unwarranted interference with personal liberty and an attempt at class legislation. There can be nothing, says the Court, in the use or representation of the Stars and Stripes to belittle or degrade the United States ensign. On the contrary, its depiction and the colors that usually accompany such decoration must inspire a feeling of patriotism.

John H. McPike, the manager of the cigar department of a general store, was arrested some months ago for offering for sale several brands of cigars upon the boxes of which the Stars and Stripes were displayed.

The Appellate Division upholds his release on a writ of habeas corpus, saying that it is nowhere apparent that the defendant's cigar box labels tended to degrade or belittle the flag. The trademark and label adopted by the cigarmakers had been used long before the passage of the amendment to the Code, and had always been considered legitimate. The right to a trademark, says the Court, is a well-defined property right.

While it is plain that the provision of the Code regarding the defilement, mutilation or degradation of the flag comes well within the authority and police power of the legislature, the same cannot be said of the provisions regarding advertisements. If the flag is publicly degraded, says the Court, there is liable to be popular anger and possibly riot. Therefore, the legislature in its police power has the right to make such defilement a crime.

But; continues the Court, the advertisement provisions are unwarranted and unconstitutional. In the first place, they are an unjustifiable interference with the liberty of citizens, and secondly they exercise an unjust discrimination and interfere with commerce.

The law also, says the Court, clearly makes a class discrimination which is unconstitutional, since book publishers, jewelers, stationers, and newspaper proprietors are expressly exempted from its penal provisions.

A Wire Rope Trademark Decision.—The A. Leschen & Sons Rope Company filed a bill in equity against the Broderick & Bascom Rope Company, seeking to enjoin the alleged infringement of a registered trademark which was thus described: "The trademark consists of a red or other distinctively colored streak applied to or woven in a wire rope. The color of the streak may be varied at will so long as it is distinctive from the color of the body of the rope."

Judge Adams of the United States Circuit Court sustained a demurrer filed by the defendant. The court said:

"I cannot escape the conviction at the outset that the mark claimed by complainant is obnoxious to the first principles of the law governing the acquisition of a valid trademark. At common law the mark must be some symbol or device not descriptive of the character, quality, or composition of an article, of the place where it is manufactured, but such a thing as indicates origin or ownership of the goods.

"One might as well say that a manufacturer of chairs can adopt the diagram of a chair, or that a watchmaker can adopt the diagram of a watch or a stovemaker the diagram of a stove, unaccompanied by any surrounding form, figure, symbol or display, as his trademark."

Referring to that portion of the complainant's description of the trademark in which it says "the color of the streak may be varied at will as long as it is distinctive from the color of the body of the rope, the court says:

"This permissible shifting of the most striking feature of the mark from time to time is in itself fatal to its validity. The fundamental purpose of the trademark is to indicate on sight the ownership or origin of the goods to which it is applied. It must therefore be permanent, the same to-day, to-morrow and at all times, otherwise its legitimate purposes cannot be subserved and the public may readily be deceived."

Quoting from Brown on trademarks the court says:

"We can describe and recognize a Maltese cross, a diamond within a circle, a five-pointed star, a flag of fixed proportions, having a certain number of stripes and stars or national emblems. Then color may well be a valid essential constituent, but it is hardly within the range of possibility to convey an adequate idea of a thing which has no fixed, invariable limits."

An Important Aluminium Reduction Patent Construed.—The Circuit Court of Appeals in the case of the Electric Smelting and Aluminium Company vs. the Pittsburg Reduction Company (125 Fed. Rep., 926), upheld the validity of the Bradley patent 468,148 for a process of separating metals from their highly refractory ores, relating especially to aluminium ores. The essential features of this process are first, dispensing with external heat, and secondly, the use of the same electric current to produce and maintain fusion and to electrolyze the ore. The court held that this patent was not anticipated, and that its claims were entitled to a liberal construction. The Court held that the Hall process covered by patent 400,766, in which cryolite is used as a fusing bath for alumina, while an improvement upon is also an infringement of the Bradley process when practised without the use of external heat for fusing the ore.

The defendants relied upon the experiments made by Sir Humphry Davy in 1807 as an anticipation of the Bradley process. Davy decomposed small pieces of moistened potash or soda by using an electric current to effect both fusion and decomposition. The Court thought that these interesting experiments could not be held to anticipate the Bradley process, in view of the facts that the materials operated upon were wholly different, and that for seventy-five years, with full knowledge of these experiments, chemists and electricians were unable to make the possibilities suggested thereby practically available for the separation of aluminium from its ores. This decision is all the more just when it is considered that the attempts of Davy himself to separate aluminium by means similar to those employed with soda and potash, were unsuccessful. The Court stated the underlying rule thus: A process is not an anticipation of one subsequently patented unless, if invented later, it should have been an infringement.

Are Stage Renditions of Songs Copyrightable?—The case of Bloom & Hamlin vs. Nixon, decided by the Circuit Court for the Eastern District of Pennsylvania, presents a state of facts which are of peculiar interest. The plaintiffs were owners and producers of a copyrighted song, which was rendered during the performance of an extravaganza by an actress who was required during the action to step to one of the boxes, single out a particular person, and sing the song to him alone, assisted in the chorus by a number of other actresses. The court held that an imitation of the actress while singing such song by another actress, in which she, in good faith, attempted to mimic the postures and gestures of the original actress, and used the chorus of the song only as a vehicle for the imitation, was not prohibited by Rev. St., Sec. 4966, as amended in 1897 [3 U. S. Comp. St. 1901, p. 3,415], prohibiting any person from publicly performing or representing any dramatic or musical composition for which a copyright had been obtained, without the consent of the proprietor.

Merely changing the form or condition of a substance by mechanical means, by grinding or reducing it to a finer state, or, conversely, by producing it in a granular, instead of a powdered, form, does not make it a new article, in the sense of the patent law, where it remains unchanged in composition and properties.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

SOUND-MAGNIFIER FOR RELAYS.—M. A. HACKER, Irvine, Ky. In this patent the invention relates to that form of device which is designed to do away with the local-battery circuit and sounder as ordinarily employed on telegraph-lines and which comprehends means for amplifying the sound of the relay as operated directly on the relatively weak electrical current on the line.

Hardware.

SASH-CORD SUPPORT. — J. KREIMER, Piqua, Kan. The invention refers to means for supporting sash-cords and counterbalancing-weights for window-sashes, and its object is to provide a sash-cord support that is adapted for convenient and quick application, and that may be firmly but detachably secured in the window-casement jamb, and that will afford a reliable support for the sash-cord, sash, and weight when applied for service.

JOURNAL-BEARING FOR TRUCK WHEELS AND CASTERS.—G. P. CLARK, Windsor Locks, Conn. The object of the invention is to provide a bearing for truck wheels and casters for hand and platform trucks used in stores, banks, offices, and the like and arranged to prevent the axle from running dry in its bearings and to allow of conveniently and readily taking up the wear of the parts to prevent rattling, thus rendering the device noiseless.

Machines and Mechanical Devices.

FRICTION-GEAR.—S. C. SPANGLER, Clyde, Oklahoma Ter. Briefly stated, the apparatus comprises a driving-shaft having two spaced gear-disks fast thereon, the driven element or elements having gears set between the gear-disks and means for moving the gears of the driven elements into engagement with either of the disks, whereby to drive the driven elements in either direction.

PRINTING BY MEANS OF ELASTIC ROLLERS OR PLATES.—E. SCHOENING, Berlin, Germany. In this instance the invention relates to printing-machines, and more particularly to that class of machines employed for grounding wall-paper, and has for its object to produce an ornamental ground on the paper. A ground is produced on the paper having two shades of the same color at one and the same operation and by the same printing-surface. The invention utilizes the pattern-surface and the color removed from the printing-surface in producing the pattern on a printing-surface to print a second web, thus producing a duplex machine.

METHOD OF PRINTING.—E. SCHOENING, Berlin, Germany. The invention consists in producing a pattern in the color or ink on a printing-surface and transferring the pattern thus produced on the printing-surface to a sheet, web, or the like. Also it consists in subjecting the colored or inked surface of a printing-surface to impressions of a pattern-surface to wholly or partially remove the color or ink from portions of the printing-surface to produce a pattern in the color thereon, which when transferred to a sheet or web will be in two shades of the same color.

THREAD-CUTTING MACHINE.—G. A. ENSIGN, Defiance, Ohio. This machine is more especially designed for cutting threads on wooden articles—such as insulator-pins, brackets, spools, bobbins, handles, barrels, etc.—and arranged to cut any desired number of threads per inch for a desired distance of the same or different diameters and irrespective of the shape of the work and to produce threads exceedingly smooth, clean, and true.

HANGER-BOX.—M. H. DETTE, New York, N. Y. In carrying out this invention Mr. Dette has in view the construction of a box which will have the body portion thereof varying in thickness—that is to say, more material will be placed in the shell or body of the box at certain points to add to the strength of the same. Also an object is to construct a box in which the shaft may be easily hung, the portions of box being so correlated and arranged that the shaft may be thoroughly lubricated at all times.

ROLLER FOR LAUNDRY MACHINES.—W. E. CUMBACK, San Francisco, Cal. This roller employs an air cushion between a comparatively solid core or roller-shell and a fibrous jacket or cover, the cushion preferably formed by a layer of hollow tubing wound spirally around the core and presenting an external smooth surface for the reception of an inclosing casing. Provision is made to maintain air in the cushion in order to secure uniform elasticity throughout the length and peripheral surface of the roller, and this cushion may be maintained by inflating the cushion under pressure or permitting atmospheric air to circulate freely through the coils of the cushion.

NEEDLE-THREADING ATTACHMENT FOR SEWING-MACHINES. — L. BERNARD, New York, N. Y. In this patent the invention has for its object the provision of an attachment for sewing-machines that will afford means for guiding the end of a thread into the eye of the sewing-needle, a further object being to adapt the improvement for a secured connection with the presser-foot on different kinds of sewing-machines.

Of Interest to Farmers.

SEED-PLANTER.—F. W. STANLEY, McComb, Miss. In this instance the object is to provide details of construction for a seed-planting device which afford means for dropping a desired number of seeds properly spaced apart in hills and expose the seed selected for each hill at the moment it is being dropped, thus enabling the operator to see that a proper number is planted in each hill as the work progresses.

LAND-EVENER.—F. W. ARNDT, Platte Center, Neb. The purpose of the invention is to furnish a machine for evening the ground so constructed that the finger of front and rear bars can be adjusted to more or less forcibly touch the ground at an inclination and be held in adjusted position until released and wherein when the evener-bars are adjusted from engagement with the ground adjustably-mounted supporting-wheels will be brought into position to form roller-supports for the device, enabling it to be readily drawn to or from the field.

Railways and Their Accessories.

AUTOMATIC LOCOMOTIVE-ALARM.—C. D. KING, Olympia, Wash. This mechanism sounds an alarm upon locomotives when two are oppositely approaching each other on the same track. A spring-gong placed in the cab, to the stop-pin of which is attached a cord conveyed through the cab side and stretched across the space between two horizontal bars projecting from the cab side one above the other so that when the cord contacts with an arm attached to a tower by the side of the railroad-track it withdraws the stop-pin and sounds the gong. The arm in the tower is held in place by pneumatic pressure created by the opposite approaching locomotive.

RAILWAY-SWITCH.—J. J. HOOPER, Chillicothe, Ohio. This switch is adapted to be opened and closed manually, but which will close automatically after a train has passed some distance on the siding or will be closed automatically by a train approaching from either direction on the main line. In carrying out this improvement two locking mechanisms are employed which may be released by means connected with the main line and the siding and which are so connected as to coact.

Pertaining to Vehicles.

FIFTH-WHEEL.—J. SOMMER, Kearney, Neb. Mr. Sommer's invention relates to fifth-wheels for vehicles, and his object more particularly being to produce a strong and compact wheel provided with both ball and slide bearings and having the advantages of being unable to readily come apart, of doing away with several parts ordinarily used, and also preventing rattling and entrance of dust.

ATTACHMENT FOR VEHICLE STEERING-GEAR.—G. D. SMITH, Montclair, N. J. In this improvement the inventor provides a clip which fastens to the free end of the steering-handle and which carries a fork, this fork being arranged to embrace the knee of the driver and being mounted in the clip, so that it may be swung into vertical or horizontal position, the latter being the inactive position, the vertical the active. The fork is also made adjustable as respects the distance between its limbs, so as to fit it to any sized person within the range of the fork adjustment.

FOLDING VEHICLE.—C. E. FANNING, Davenport, Iowa. This invention refers to folding carriages, shown and described in the Letters Patent formerly granted to Mr. Fanning. The object of the present invention is to provide improvements in folding baby-carriages whereby the carriage can be readily changed from a folded to an extended or set-up position, and *vice versa;* and when set up for use is not liable to accidentally close or collapse.

Miscellaneous.

NECKTIE.—C. NOLLENBERGER, Leadville, Col. The purpose of the invention is to so construct the tie that it can be quickly and readily attached to or detached from the neck-band, shield, or other support and reversed, carrying the former front soiled face to the back and the rear unsoiled face to the front, and to provide manipulating fastening devices whereby to adjustably secure the bow to the support provided for it. Mr. Nollenberger has invented another necktie, the purpose of which is to provide a bow of any description and so made that it may be worn with either face presented to the front, and when both become worn whereby the tie, which is in adjustably-connected sections, may be manipulated to bring the former intermediate faces outward, thereby presenting a fresh front and rear surface, the tie under such adjustment being reversible, whereby to use both front and back surfaces.

SEWING-AWL.—T. O'SHAUGHNESSY, San Jose, Cal. This invention relates to improvements in awls designed particularly for use in repairing leather goods—such as harness, shoes, gloves, etc.—an object being to provide a sewing-awl adapted to be operated manually in making repairs and that shall be simple in construction and convenient to handle.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
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Marine Iron Works. Chicago. Catalogue free.

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AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 5154.—For makers of street lamps.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 5155.—For manufacturers of gang plows.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 5156.—Wanted, a high Columbia bicycle or Star wheel.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 5157.—For a power machine for weaving wire.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5158.—For makers of agricultural implements.

American inventions negotiated in Europe. Felix Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 5159.—For makers of lighting rods.

Non-refillable bottle. Simple, practical and non-refillable. Address R. T. McKenzie, Spring Hill, Miss.

Inquiry No. 5160.—For makers of electric welding machines.

WANTED.—Manufacturer on royalty for a patented machinists' tool. Address Profitable, Box 773, N. Y.

Inquiry No. 5161.—For machines for making paper tubes similar to shotgun shells.

Edmonds-Metzel Mfg. Co., Chicago. Contract manufacturers of hardware specialties, dies, stampings, etc.

Inquiry No. 5162.—For manufacturers of hand warmers.

Machine Work of every description. Jobbing and repairing. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

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☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway New York. Free on application

Inquiry No. 5164.—For the address of Pomeroy, manufacturer of small saws, patterns, supplies for sawing, etc.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and band organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5165.—For manufacturers of glass paper weights for advertising purposes.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 5166.—For machinery for making school slates and frames for the same.

Empire Brass Works, 106 E. 125th Street, New York, N. Y., have exceptional facilities for manufacuring any article requiring machine shop and plating room.

Inquiry No. 5167.—For manufacturers of awning hardware.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5168.—For makers of foot power lathes for buffing and polishing.

In buying or selling patents money may be saved and time gained by writing Chas. A. Scott, 705 Granite Building, Rochester, New York.
Highest references.

Inquiry No. 5169.—For apparatus to distill wood alcohol and save the by-products.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 16 South Canal Street, Chicago.

Inquiry No. 5170.—For a machine for converting rice into a powder of a fineness to warrant its use as a cosmetic.

Territorial Rights for sale, side rail burglar proof fastener and ventilator, Patent No. 750,430. Meets a great demand. Full information by addressing
Joseph Anderson, Seattle, Wash.

Inquiry No. 5171.—For machinery for weaving the Agave and for all the operations done with the plant.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits. Early American Illustrated Magazines. Early Patents signed by Presidents of the United States. Valentine's Manuals of the early 40's. Correspondence solicited. Address C. A. M., Box 773, New York.

Inquiry No. 5172.—For makers of metal goods, such as hinges for pocket books, and knobs for covers, etc.

An estate, holding a controlling interest in a corporation manufacturing patent devices for use in the equipment of power plants, will sell its entire holdings to enable it to adjust estate matters. An excellent opportunity for any one who can take an active part in the management of the company. Not over $15,000 necessary. Full particulars furnished and no names of inquirers disclosed. Elliott, Box 773, New York.

Inquiry No. 5173.—For automatic machinery for turning spools, knobs, handles, etc.

Cash paid for second hand material, gas mantle clippings and dust, metallic bismuth, mercury, platina, bronze powder, etc.
Josef Radnai, 231 E. 80th St., New York.

Inquiry No. 5174.—For manufacturers of machinery for making chewing gum.

Inquiry No. 5175.—For manufacturers of briquettes for use in carriage heaters.

Inquiry No. 5176.—For makers of statuettes and small novelties in plaster, bisque, papier maché and white metal.

Inquiry No. 5177.—For makers of hand or foot power machines for grinding lawn mowers.

Inquiry No. 5178.—For manufacturers of coal mining machinery.

Inquiry No. 5179.—For manufacturers of tobacco-cutting machines.

Inquiry No. 5180.—For manufacturers of cigarette-making machinery.

Inquiry No. 5181.—For the address of the maker of or dealer in the "Wonder-Working World."

Inquiry No. 5182.—For makers of laundering machinery.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9319) E. N. asks: How many pounds will a fan pull, 5 feet in diameter with four blades, the size of the blades at end to the shaft being 8¼ inches and 20¼ long by 24¾ at the wide end, at a speed of 1,000 R. P. M.? Also state horse power required to run a fan that size and speed. A. The draft of a fan varies with the speed nearly as the square of the number of revolutions per minute; and also with the angle of the blades. We estimate that the fan you describe will pull a force of 9 ounces per square inch, and will require 10 horse power to run it at 1,000 revolutions per minute.

(9320) D. E. S. says: In reference to query 9286 by F. B. in issue of January 23, 1904, you have repeatedly, in back numbers of the SCIENTIFIC AMERICAN, answered in the hunter and squirrel puzzle that the hunter did *not* go around the squirrel (which is correct). You turn back now, and say he did. If he did, why didn't the hunter shoot the squirrel when he came in sight of it, which he logically must do to pass it, and save all these years of misery? At what point of the circle did the hunter first see the squirrel? May I be allowed to add a dog to the circus, which also passes around the tree with the hunter, but on a circle slightly less in diameter than the hunter. Does the hunter go around the dog too? The circles made by the squirrel and dog do not enter into the question. A. We have answered the squirrel question perhaps a dozen times within a year, and always the same way. No other answer has been given for the last seven years, since the present editor has been in charge, and we do not expect to reverse our opinion. It is simple nonsense to say that the man must *see* the squirrel if he goes around it. Suppose the tree to be hollow and the squirrel were in the inside of the tree, how would the man see it? Nor does a dog make any difference, except to confuse the thinking in regard to the squirrel.

(9321) H. W. F. writes: Some time ago I visited a factory in which large thin pieces of crucible steel were heated in a molten metal for tempering. I presumed the metal to be lead, but upon trying molten lead for the same purpose, I find that so much dross accumulates on the surface, and so quickly, that it is almost impossible to get any of the pieces of steel to come away from the bath quite free from dross. I believe now that the bath which I saw was not lead, but some other metal or mixture. Can you suggest a metal or a mixture of metals that in the molten state would remain free from dross on surface? A. Melted lead is the only metal that is used for the hardening bath. The lead should be skimmed clear and powdered charcoal spread on the surface of the lead. Sometimes carbonate of soda is sprinkled on the surface; it gathers the lead oxide. If the soda sing sticks to the articles, it is thrown off when the articles are dipped in the water.

(9322) C. T. asks: Please answer in your Notes and Queries columns the following questions: Do you think that telephones will ever take the place of the telegraph in railroading? Can light be seen? If so, how? A. It seems very unlikely that the telephone will ever drive out the telegraph. The telegraph gives a copy which is a permanent record of what has been sent. The telephone does not. The telephone is limited in distance more than the telegraph.—Light is invisible. We see objects, not the light which makes the object visible; the flame of a lamp, not the light which the flame gives to render things in the room visible.

(9323) F. F. asks: It would be a favor if you would let me know how to make and use the dip solution that is used to make old brass articles look new. The color desired is the same color as a new movement of a clock, and is of a yellow green. I understand that the articles are lacquered after the dip. A. The bright luster on brass articles by the dipping process is made by first cleaning the articles from grease or dirt by dipping in a hot and strong solution of soda or lye. Rinse in hot water and dry in clean sawdust. Then dip in

an acid bath of equal parts of sulphuric and nitric acids, strong, for a few seconds or until a bright color is produced, wash quickly in boiling hot water, dry and lacquer with a thin solution of shellac in pure alcohol. The articles should be heated as hot as boiling water, and apply the lacquer quickly with a soft brush.

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February 16, 1904,

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Stove, P. J. Coppens	752,144
Stoves, system of feeding slow burning, E. Engels	752,389
Strainer for down spouts, self-cleaning, Harris & Adams	752,547
Straining device, liquid, J. H. Adwen	752,019
Streets, etc., sprinkling, L. S. Van Westrum	752,485
Streets, sprinkling, L. S. Van Westrum	752,487
Sulphuric anhydrid, contact apparatus for the production of, W. Hasenbach	752,165
Suspender attachment, H. G. Geer	752,149
Suspenders, M. Hynson	752,558
Suspenders, C. A. Lations	752,568
Sweeping machine, Green & Larsson	752,152
Syrup, J. J. Reed	752,359
Tag making machine, J. C. Taft	752,601
Target trap, P. North	752,407
Target trap-releasing means, S. A. Huntley	752,557
Teeth and mouth, casting impressions of the, W. M. Dailey	752,378
Telegraph pole, J. H. Purdy	752,259
Telephone system, automatic, Nornstrom & Browning	752,251
Telephone transmitter hanger, M. Setter	752,184
Thermometer case, antiseptic, P. C. Hay	752,395
Threshing machine, N. G., T. D., & J. M. Ross	752,182
Threshing machine, R. N. McClanahan	752,576
Threshing machine, etc., coupling, W. J. Randolph, Jr.	752,300
Ticket, unalterable duplex, J. J. McGuirk	752,286
Tie rod connection, G. G. Guy	752,065
Time table appliance and advertising device, H. L. Warrens	752,274
Tire gage, F. Curran	752,526
Tire mounting apparatus, R. B. Price	752,415
Tire, pneumatic, H. E. Irwin	752,228
Tire, rubber vehicle, R. B. Price	752,416, 752,417
Toaster or broiler, G. R. Wilson	752,497
Toilet chair, G. W. Hessler	752,551
Towel, F. Clowley	752,033
Trace holder, B. Johnson	752,560
Trace hook, releasing, W. Carter	752,029
Train service, electric, M. D. Compton	752,037
Transformer, C. B. McCurdy	752,405
Transmitting intelligence through the natural mediums, D. Drawbaugh	752,534
Tripod, G. F. Smith	752,423
Trolley catcher, Young & McMahon	752,139
Trolley cords, automatic check device for, S. J. Buckland	752,374
Trolley finder, E. S. Stitt	752,121
Trolley guide, overhead, C. W. Burkhead	752,437
Trolley hanger, M. M. Wood	752,501
Trousers creaser, E. C. Chandler	752,141
Truck, pedestal, J. M. Hansen	752,290
Truck, railway, A. Stucki	752,308
Trucks from cars, device for releasing, B. L. Riley	752,467
Truss, D. T. Foley	752,445
Tumbling barrel, W. H. Hart	752,160
Turbine, H. Holzwarth	752,340
Turbine bearing, H. Holzwarth	752,224
Turbine, elastic fluid, J. Wilkinson	752,610
Turbine, steam, De Goede & Groot	752,545
Turbine, two speed and reversing, J. Wilkinson	752,496
Turnbuckle, safety, E. H. Cowart	752,524
Typewriter carriage, C. D. Rice	752,106
Typewriter carriage construction, J. Alexander 752,191,	752,611
Typewriter paper guide, O. C. Kavle	752,076
Typewriter paper release device, L. Myers	752,092
Typewriters or the like, type bar construction for, E. F. Kunath	752,077
Typewriting machine, L. P. Diss	752,210
Typewriting machine, W. C. Farnum 752,214,	752,215
Typewriting machine, J. W. Schuckers	752,422
Typewriting machine paper edge guide, J. C. McLaughlin	752,094
Typewriting machine paper guide, F. X. Wagner	752,131
Typewriting machine tabulating mechanism, C. N. Fay	752,540
Umbrella, C. N. Christensen	752,032
Umbrella lock, combination, R. B. Waite	752,489
Umbrella notch, A. M. Peate	752,178
Underwaist and garment supporter, combined, L. M. Jones	752,343
Upholstery spring top clamp, P. F. King	752,169
Valve, J. W. Nethery	752,176
Valve, Halley & Downey	752,220
Valve, J. W. Master	752,241
Valve, J. Utrilla	752,608
Valve, ball cock, C. C. Tozier	752,314
Valve, emergency, W. Cooper	752,204
Valves, internal combustion engine, C. E. Sargent 752,303,	752,304
Valve, locomotive, Coryell & Stephens	752,439
Valve mechanism, E. Kromer	752,400
Valve mechanism, M. Schilde 752,471,	752,472
Valve, safety, C. C. Palmer	752,099
Valve, steam engine reversing, E. Kromer	752,401
Valves or equivalent means of hydraulic apparatus, mechanism for operating, H. E. Warren	752,491

Vehicle, C. O. Barnes	752,435
Vehicle brake, W. D. Brown	752,328
Vehicle braking mechanism, motor, Packard & Hatcher	752,582
Vehicle step, folding, L. S. Chadwick	752,031
Vending machine, J. P. Beardslee	752,322
Vending machine, coin controlled, Nash & Wanger	752,580
Ventilators, Sew Boot or shoe ventilator	
Vise, H. E. Reed	752,266
Voting machine, P. Yoe	752,270
Voting machine, St. Louis & Jackson	752,307
Wagon, dumping, J. S. Danley	752,206
Wagon unloading mechanism, M. O. Clark	752,519
Wardrobe bracket, J. Ternes	752,128
Warping machine, W. J. Garlick	752,393
Washboiler attachment, W. J. Bartlett	752,506
Water closet attachment, P. H. Bacon	752,321
Water meter, O. Braun	752,326
Water pipe mute, A. P. Mounier	752,175
Water supply apparatus for cattle, poultry, etc., G. Hacker	752,155
Water tube boiler, G. E. Turner	752,630, 752,631
Watering apparatus, poultry house, G. Hacker	752,154
Watering apparatus, stock, G. Hacker	752,157
Weather strip, G. L. Parker	752,355
Weather strip, W. H. Etter	752,390
Welding apparatus, H. Dick	752,208, 752,209
Wheelbarrow, G. G. Tieman	752,190
Whiffletree hook, G. D. Hayes	752,222
Wick, lamp, J. A. Mosher	752,575
Windmill, C. O. Sylvester	752,126
Wire or cable stretcher, Huerth & Olson	752,621
Wood working machine feeding device, Thomas & Spencer	752,313
Wrench, M. Wenger	752,136
Wrench, W. J. Berryman	752,510
Wrench, C. S. Kline	752,564
Yarn or thread lubricator, C. J. Lehman	752,458
Yoke, P. N. Lear	752,083

DESIGNS.

Building block, artificial, H. S. Palmer,	36,804 to 36,806
Charm or similar article, W. W. Chase	36,793
Collar, W. Helbig	36,807
Collar, F. Edelmann	36,808, 36,809
Flower box, renaissance, F. Hinderer	36,801
Flower pot, hanging, F. Hinderer	36,800
Lamp chimney reflector, L. Sepulchre	36,802, 36,803
Pencil, lead, E. L. Schmitz	36,798
Spoons, forks, or similar articles, handle for, J. E. Straker, Jr.	36,794 to 36,796
Suspender button piece, W. H. Johnson	36,797

TRADE MARKS.

Beverage manufactured from apple cider, Morgan-Lyons Vinegar Co.	42,078
Beverages, composite material for making, S. B. Dexter	42,076
Boots and shoes, leather, R. L. Reom	42,066
Candy, Postum Cereal Co.	42,072
Cigar box flavor, J. J. Meuwly	42,073
Coal, anthracite, Virginia Anthracite Coal Co.	42,088
Coffees, E. S. Pike	42,075
Cognac, Strauss & Co.	42,080
Drink, certain named non-alcoholic, S. Becker	42,077
Flour, wheat, Kehlor Flour Mills Co.	42,082
Furniture polish, Mexican Manufacturing Co.	42,083
Games played with cards, Parker Bros.	42,055 to 42,058
Hose supporters, I. B. Kleinert Rubber Co.	42,061
Jewelry, certain named, Donley & Co.	42,059
Lamps, central draft, Pittsburg Lamp, Brass & Glass Co.	42,089
Lotion to be applied to the face and hands, Cumalena Manufacturing Co.	42,070
Medicinal preparation for cure of certain named diseases, R. F. Burnham	42,069
Metal, babbitt, L. Cohen	42,090
Metal productions, certain named, Chrome Steel Works	42,091
Oil, olive, Los Angeles Olive Growers' Ass'n.	42,081
Remedies for certain named diseases, W. M. Starr	42,068
Rubber footwear, certain named, Banner Rubber Co.	42,067
Silk fabrics, York Silk Manufacturing Co.	42,062 to 42,064
Sleds, S. L. Allen	42,092
Soot destroyers, composition, Gourmet & Co.	42,087
Suspenders, Weberaft Co.	42,085
Teeth, porcelain, Dentists' Supply Co.	42,060
Tobacco, plug and cut plug chewing, W. A. Brown Tobacco Co.	42,074
Toilet preparations, certain named, R. G. Kirsch	42,071
Varnish, spirit, Berry Brothers	42,084, 42,085
Welding compounds, Welding Compound Co.	42,086
Whisky, Strauss & Co.	42,079

LABELS

"Bader's Foot Relief," for foot relief, H. F. Bader	10,745
"Dan Patch," for cigars, Forest City Cigar Co.	10,746
"Dr. Antrim's Inhalant," for medicine, M. J. Holp	10,742
"Iodinized Emulsion, (Scott.)" for an emulsion, Dawson Pharmacal Co.	10,744
"L'Acadie," for olive oil, Acker, Merrall & Condit Co.	10,749
"McKinley Cough and Cold Cure," for medicine, C. O. Larter	10,743
"Politics," for a game, W. A. T. Jones	10,741
"Red Ribbon Cocoa," for cocoa, Runkel Bros.	10,748
"Rosen's Best," for snuff, I. Rosen	10,747
"20th Century Stock Food," for stock food, W. H. Eason	10,761
"Type Soap," for saponaceous compounds, Type Soap Co.	10,762
"Veribest Beef Loaf," for beef loaf, Armour & Co.	10,759
"Veribest Brisket Beef," for brisket beef, Armour & Co.	10,757
"Veribest Chicken Loaf," for chicken loaf, Armour & Co.	10,754
"Veribest Deviled Ham," for deviled ham, Armour & Co.	10,751
"Veribest Ham Loaf," for ham loaf, Armour & Co.	10,758
"Veribest Lunch Tongue," for lunch tongue, Armour & Co.	10,756
"Veribest Potted Ham," for potted ham, Armour & Co.	10,760
"Veribest Roast Beef," for roast beef, Armour & Co.	10,750
"Veribest Sliced Smoked Beef," for sliced smoked beef, Armour & Co.	10,755
"Veribest Veal Loaf," for veal loaf, Armour & Co.	10,753
"Veribest Vienna Sausage," for Vienna sausage, Armour & Co.	10,752

PRINTS.

"Instructions 'Yankee' Safety Razor," for safety razors, Reichard & Scheuber Manufacturing Co.	901
"Our Footwear Attracts," for shoes, O. McCormick	897
"The Only Third Party Welcomed on These Occasions," for cocoa, Runkel Bros.	902
"We have Competition Beat a Mile," for shoes, O. McCormick	899
"Womens' Artistic Easter Foot-Wear," for shoes, O. McCormick	898
"You Will Be Surprised," for shoes, O. McCormick	900

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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